5 SUMMARY OF SITE CHARACTERISTICS

The characteristics such as physiography, meteorology, hydrology, soils, and ecology specific to the ANL-W site are summarized in Sections 5.1 through 5.6. These characteristics are included to help the reader understand the specific details needed to assess the alternatives in the ROD. A complete discussion of each of these can be found in chapter 2 of the 9-04 Comprehensive RI/FS. Sections 5.7.3 through 5.7.13 identify the nature and extent of contamination at each of the eight areas that are retained for cleanup.

5.1 Physiography

The SRP, is the largest continuous physiographic feature in southern Idaho. This large topographic depression extends from the Oregon border across Idaho to Yellowstone National Park and northwestern Wyoming. Figure 2-1 shows the location of the Snake River Plain Aquifer with respect to the INEEL and the State of Idaho. The portion of the SRP occupied by the INEEL may be divided into three minor physical provinces: a central trough that extends to the northeast through the INEEL and two flanking slopes that descend to the trough, one from the mountains to the northwest and the other from a broad ridge on the plain to the southeast.

The ANL-W facility is found in the southeastern portion of the INEEL and is responsible for a roughly rectangular-shaped administrative area encompassing approximately 890 acres. A double security fence with largest east-west and north-south dimensions of 580 m and 765 m (1,902 ft and 2,512 ft), respectively, surrounds the major portion of ANL-W. Located inside the fenced area are more than 60 buildings and 13 temporary trailers. Located outside the security fence are six buildings/facilities that support the ANL-W facility. One building that support the Transient Reactor Test Facility, the three sanitary Sewage Lagoons, the Radioactive Scrap and Waste Facility, the security forces firing range, the parking lot, and the helicopter landing pad. Outside the perimeter of ANL-W are unpaved roads, groundwater monitoring wells, the interceptor canal, industrial waste pond, three old construction rubble burn areas, and borrow excavation pits used for construction at ANL-W facilities. All ANL-W facilities are within a local topographically closed basin. The surface of the facility slopes gradually from south to north, at approximately 30 ft per mile. Maximum topographic relief within the ANL-W administrative boundary is about 50 ft, ranging from 5,110 ft above mean sea level on the north boundary to 5,160 ft on a basalt ridge to the southeast.

The Twin Buttes are the most prominent topographic features within the INEEL and are found to the southwest of ANL-W. East and Middle Twin Buttes rise 1,100 and 800 ft, respectively, above the plain. Big Southern Butte, a composite acidic volcanic dome several miles south of the INEEL, is the most prominent single feature on the entire plain, rising approximately 2,500 ft above the level of the plain.

5.2 Meteorology

The U.S. Weather Bureau established a monitoring station at the Central Facilities Area (CFA) in 1949. A 250-ft tower is also located just outside the east security fence of the ANL-W area; however, this tower has not been in continuous operation for as long as the CFA station. The longest and most complete record of INEEL meteorological observations exists for the CFA weather station. Although meteorological conditions between the ANL-W and CFA facility are similar, the ANL-W site specific conditions were used.

5.2.1 Air Temperature

Data have been collected from both the two- and ten-meter above the ground surface at ANL-W. The two-meter data set is limited in time from August 1993 to the present. The record presented is considered typical of temperature conditions in the vicinity of the ANL-W facility. Although there is a much longer record available from the CFA station, the distance of ANL-W from that station precludes its use. Therefore, these data are presented here because they more accurately portray surface conditions at ANL-W. The maximum average monthly temperature during the time of record was 84.8°F for July and the minimum average monthly temperature of 7.9°F was recorded in December.

5.2.2 Precipitation

Precipitation is not measured at the ANL-W tower. However, the National Oceanic and Atmospheric Administration (NOAA) conducted an evaluation and the use of CFA data for these parameters is reasonable. Precipitation was measured as rainfall and snowfall for the period January 1950 to December 1988. During this period, most of the precipitation was received in May and June and averaged 1.2 inches, while the annual total average was 8.71 inches. As could be expected, most snowfall occurred during December and January. The monthly average snowfall event for December and January was 6.4 and 6.1 inches, respectively. Wet bulb temperature humidity measurements from CFA run from 1956 to 1961. The highest average occurred in the winter at 55%; a low average of 18% was recorded in the summer.

5.2.3 Evaporation and Infiltration

Although NOAA does not measure pan evaporation at the INEEL, adjusted Class A values have been made through regression analysis of other southeast Idaho sites. Data from 1950–51, 1958–59, 1963–64, and 1969–70 yielded an adjusted range of 40 to 46 inches per year. Other estimates for the INEEL have values of 36 inches per year from saturated ground, 32 to 36 inches per year from shallow lakes, and 6 to 9 inches per year from native vegetation. Evaporation rates calculated from the drop in level of the ANL-W Industrial Waste Pond (IWP) yield values between 0.85 and 0.14 inches per day for summer and winter, respectively. Infiltration as calculated by using the hydrologic equation (Equation 5.1 of *Water Supply and Pollution Control, Fourth* Edition) and solving for the infiltration term. This yields values for the IWP of between 0.48 to 0.004 inches per day for summer and winter, respectively.

5.2.4 Wind

Wind measurements at ANL-W are made at two and ten meters and the top of the tower (250 ft above the ground surface). From these data, ANL-W is clearly subject to the same southwest and northeast winds as the rest of the INEEL. Winds tend to be diurnal with up-slope winds (those out of the southwest) occurring during the day and down-slope winds (those out of the northeast) occurring at night. During the 5-year time of record at ANL-W from 1990 to 1994, winds blew from the southwest 14% of the time, from the south-southwest 11% of the time, and from the northeast 10% of the time. Winds were calm during only 2.49% of the time on record.

5.2.5 Special Phenomena

A thunderstorm is defined by the National Weather Service as a day on which thunder is heard at a given station. According to the definition, lightning, rain and/or hail are not required during this time. Following this strict definition, the ANL-W may experience two to three thunderstorm days from June to August. Thunderstorms have been observed during each month of the year, but only rarely from November to February. Thunderstorms on the INEEL tend to be less severe than in the surrounding mountains because of the high cloud base. In many instances, precipitation from a storm will evaporate before reaching the ground. Individual storms may, however, occasionally exceed long-term average rain amounts for a storm.

Local thunderstorms may also be accompanied by micro bursts. These micro bursts can produce dust storms and occasional wind damage. Thunderstorms may also be accompanied by both cloud-to-ground and cloud-to-cloud lightning.

Major range fires in the summer of 1995 and 1996 have burned most of the natural vegetation around the ANL-W facility. Reseeding efforts were conducted in the summer of 1996 to establish new growth in the areas upwind of the access road to ANL-W. It is not known at this time what long-range impacts these range fires have had with the flora and fauna around the ANL-W facility. Early indications have shown that the wet summer of 1997 has produced abundant small grasses that may decrease the heavy demand for food at other non-burned areas around ANL-W.

5.3 Geology

Much of the INEEL's surface is covered by Pleistocene and Holocene basalt flows. The second most prominent geologic feature is the flood plain of the Big Lost River. Alluvial sediments of Quaternary age occur in a band that extends across the INEEL from the southwest to the northeast. The alluvial deposits grade into lacustrine deposits in the northern portion of the INEEL, where the Big Lost River enters a series of playa lakes. Paleozoic sedimentary rocks make up a very small area of the INEEL along the northwest boundary. Three large silicic domes and a number of smaller basalt cinder cones occur on the INEEL and along the southern boundary.

5.3.1 Surface Geology

Surficial materials at ANL-W facilities are found within a topographically closed basin. Low ridges of basalt found east of the area rise as high as 100 feet above the level of the plain. Surficial sediments cover most of the underlying basalt, except where pressure ridges form basalt outcrops. Thickness of these surficial sediments ranges from zero to 20 feet (Northern Engineering and Testing, Inc. 1988).

Test borings at ANL-W have revealed two distinct layers in the surface sediments. The uppermost layer, from zero to several feet below land surface (BLS), consists of a light brown silty loam. The upper 1 to 2 feet. of this silty loam layer contains plant roots. This silty loam layer may also contain basalt fragments in areas where it directly overlies basalt.

The lower layer is a sandy-silt (loess) that extends to the underlying basalt. The loess of this layer was probably transported by wind from other parts of the plain. The windblown loess is calcareous and light buff to brown in color. Small discrete lenses of well-sorted sands that occur within the loess are probably the result of reworking by surface runoff into local depressions. The lower portion of this loess layer often contains basalt fragments of gravel to boulder size. The surface of the underlying basalt, whether it is in contact with the upper or lower layer, is highly irregular, weathered, and often very fractured.

5.3.2 Subsurface Geology

The subsurface lithology presented in this section is based on information gathered from past and recent borings around the ANL-W facility. Information gathered from recent borings (i.e., those drilled after 1992) have lead to a better understanding of the subsurface geology around ANL-W. The deep geology around ANL-W is dominated by basaltic lava flows. Minor discontinuous sedimentary interbeds occur at various depths, overlying the tops of basalt flows.

The subsurface geology at ANL-W is similar to that on the rest of the INEEL. The most striking difference is the lack of continuous sedimentary interbeds beneath the facility. Those sedimentary interbeds intercepted during drilling appear to be discontinuous stringers, deposited in low areas on basalt surfaces. These interbeds are generally composed of calcareous silt, sand, or cinders. Rubble layers between individual basalt flows are composed of sand and gravel to boulder sized material. The interbeds range in thickness from less than 1 inch to 15 feet. In 1988, drilling near the IWP an interbed was encountered between 40 to 50 feet BLS. This interbed is not continuous across the ANL-W area and does not appear west of the IWP. More aerially extensive interbeds have been identified above the regional water table, at approximately 400, 550, and 600 feet. BLS (Northern Engineering and Testing, Inc. 1988). The depth to the SRPA below the ANL-W facility is approximately 640 feet. BLS. The nature of these sedimentary interbeds and rubble zones does not appear to cause perching, but may retard the downward movement of water and produce preferred flow paths.

The thickness and texture of individual basalt lava flows are quite variable. Individual basalt flows range in thickness from 10 to 100 feet. The upper surfaces of the basalt flows are often irregular and contain many fractures and joints that may be filled with sediment. The existence of rubble zones at variable depths and extents are shown from caliper logs of hole diameter that reveal zones of blocky or loose basalt. Exposed fractures commonly have silt and clay infilling material. The outer portions of a flow (both top and bottom) tend to be highly vesicular. The middle portions of the flow typically have few vesicles and are dominated by vertical fractures formed during cooling.

The variability of basalt thickness and fracturing also plays an important role in well response to changes in the SRPA. This effect is most notable in well responses to barometric pressure changes. These responses to the barometric pressure changes result in groundwater elevation data that has to be corrected for barometric pressures in order to plot the contour of the water surface. Most of the wells at ANL-W act as water table wells with a rapid response to barometric fluctuations. However, wells ANL-MON-A-11 and the new well ANL-MON-A-14 are very slow to respond to barometric changes, often taking many hours to re-equilibrate to barometric shifts. Review of the driller's log for these wells shows that a thick, apparently massive basalt, rests just above the water table. This thick flow acts as a confining layer and restricts free air exchange near the well bore. Discussions with the INEEL field office of USGS suggest this is common on the INEEL and that the local area of such effects tends to be on the order of hundreds of feet. Neither the USGS nor ANL-W believes that this effect influences the wells' ability to intercept upgradient contaminants from the Leach Pit (ANL-08) and the Main Cooling

Tower Blowdown Ditch (ANL-01A). Furthermore, placement of the well away from the immediate downgradient edge of the source area allows for any lateral spreading of contaminants that may occur above this dense basalt before entry into the aquifer.

The sequence of interbedded basalt and sediments, discussed above, continues to well below the regional water table. The regional water table is typically encountered at an elevation of about 4,483 feet above mean sea level (MSL) near the ANL-W facility. A deep corehole was drilled in 1994 in an attempt to locate the effective base of the aquifer. This base is a layer below which the hydraulic conductivities drop by orders of magnitude. A large sedimentary interbed (up to 100 feet thick) and a marked change in the alteration of the basalts characterize the contact of the effective base. This contact was encountered at a depth of 1,795 feet below land surface (BLS) in the deep corehole at ANL-W. The sedimentary layer was approximately 15 feet thick.

5.4 Soils

The ANL-W site is located on a small meadow within a local drainage. The thickness of the surficial sediment in the vicinity of the ANL-W site is shown in Figure 5-1. These depths range from outcroppings at the surface to depths of 14 feet. In general, the depths of the surface soils above the basalt tend to increase from approximately 2 feet on the east side of the facility to a depth of 14 feet near the west side of the security fence.

The general soil types for the ANL-W facility are shown in Figure 5-2. The two types of soils shown in the figure for ANL-W are 425-Bondfarm-Rock outcrop-Grassy Butte complex and 432-Malm-Bondfarm-Matheson complex. As shown in the figure, the soil type 425-Bondfarm-Rock outcrop-Grassy Butte complex is found over all the sites in OU 9-04. This soil consists of 40% Bondfarm loamy sand, 30% rock outcrop, and 20% Grassy Butte loamy sand. The Bondfarm soil is found on the concave and convex side slopes and is surrounded by hummocky areas of the Grassy Butte soils. Rock outcrop is in the areas of slightly higher than areas of Bondfarm soils. Also included in this complex are about 10% Matheson loamy sand, a soil that is similar to the Grassy butte soils but that is less than 40 inches deep to bedrock, and Terreton loamy sand. The Bondfarm soil is shallow and well drained. It formed from eolian material. Typically, the surface layer is light brownish gray loamy sand about 4 inches thick. The subsoil and substratum are very pale brown sandy loam 14 inches thick. Basalt is at a depth of 18 inches. The soil is calcareous throughout and may have a layer of lime accumulation at depth. The permeability of the soil is moderately rapid. Effective rooting depth is 10 to 20 inches. Available water capacity is low. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate. The hazard of vegetated soil blowing is very slight.

Rock outcrop consists of exposed basalt rock. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and shrubs. While, the Grassy Butte soil is very deep and somewhat excessively drained. It formed in sandy eolian material. The underlying material to the depth of 60 inches or more is grayish brown and gray loamy sand. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 19 inches. The permeability of the soil is rapid. Effective rooting depth is 60 inches or more, and the available water capacity is low or moderate. Surface runoff is very slow or slow. The hazard of vegetated soil blowing is very high.

5.5 Hydrogeology

Recharge to the SRPA in the vicinity of ANL-W occurs as snowmelt or rain. During rapid snowmelt in the spring, moderate recharge to the aquifer can occur. However, high evapotranspiration rates during the summer and early fall prevents significant infiltration from rainfall during this period. Because of the distance from the surrounding mountains and permanent surface water features (i.e., the Big Lost River), the SRPA beneath ANL-W is unaffected by underflow or recharge from these sources.

No permanent, natural surface water features exist near the ANL-W site. The existing surface water features (e.g., drainage ditches and discharge ponds) were constructed for ANL-W operations for the collection of intermittent surface runoff. A natural drainage channel has been altered to discharge to the Industrial Waste Pond via the Interceptor Canal. Under the unusual conditions when the air temperature has been warm enough to cause snow-melt, but the ground has remained frozen, precluding infiltration, surface runoff along this channel has discharged to the Industrial Waste Pond. This condition most recently occurred during the spring of 1995. During this time, flow was visible from the surrounding basin into the Industrial Waste Pond for approximately 4 days. However, at no time did any water discharge from the pond to the downstream channel. Before 1995, the most recent occurrence of this situation was in 1976.

Perched water is defined as a discontinuous saturated lens with unsaturated conditions existing both above and below the lens. Classical conceptualization of a perched water body implies a large, continuous zone of saturation capable of producing some amount of water. These perched zones can occur over dense basalts that exhibit low hydraulic conductivity in addition to sediment interbeds that have low permeability. It is unknown which conceptual model is more prevalent at the INEEL. However, in the subsurface basalts at ANL-W, the "perched water" appears as small, localized zones of saturated conditions above some interbeds and within basalt fractures, which are incapable of producing any significant amount of water.

5.5.1 Snake River Plain Aquifer

Estimates show that nearly 2×10^9 acre-feet of water exist in the SRPA with water usage within the boundaries of the INEEL being approximately 5.6×10^3 acre-feet per year. From 1979 to 1994, the ANL-W withdrew an average of 138 million gallons of water per year from the SRPA. Principal uses of the water are for plant cooling water operations, boiler water, and potable water. On average, 85% of the water is discharged to either the sanitary Sewage Lagoons (ANL-04) or Industrial Waste Pond (ANL-01), 13% is discharged to the air via cooling towers, and 2% is discharged to subsurface septic systems.

Regional flow in the SRPA is from northeast to southwest. Depth to the SRPA near the ANL-W facility is approximately 640 feet BLS, based on 1995 water level measurements. Transmissivities of the SRPA range from 29,000 to 556,000 feet squared per day, based on aquifer test data from two production wells at the ANL-W. Figure 5-3 shows the location of monitoring wells near the ANL-W facility, hydraulic gradient, and the groundwater flow direction.

5.5.2 Surface Water Hydrology

Most of the INEEL is located in a topographically closed drainage basin, commonly referred to as the Pioneer Basin, into which the Big Lost River, Little Lost River, and Birch Creek may drain. As

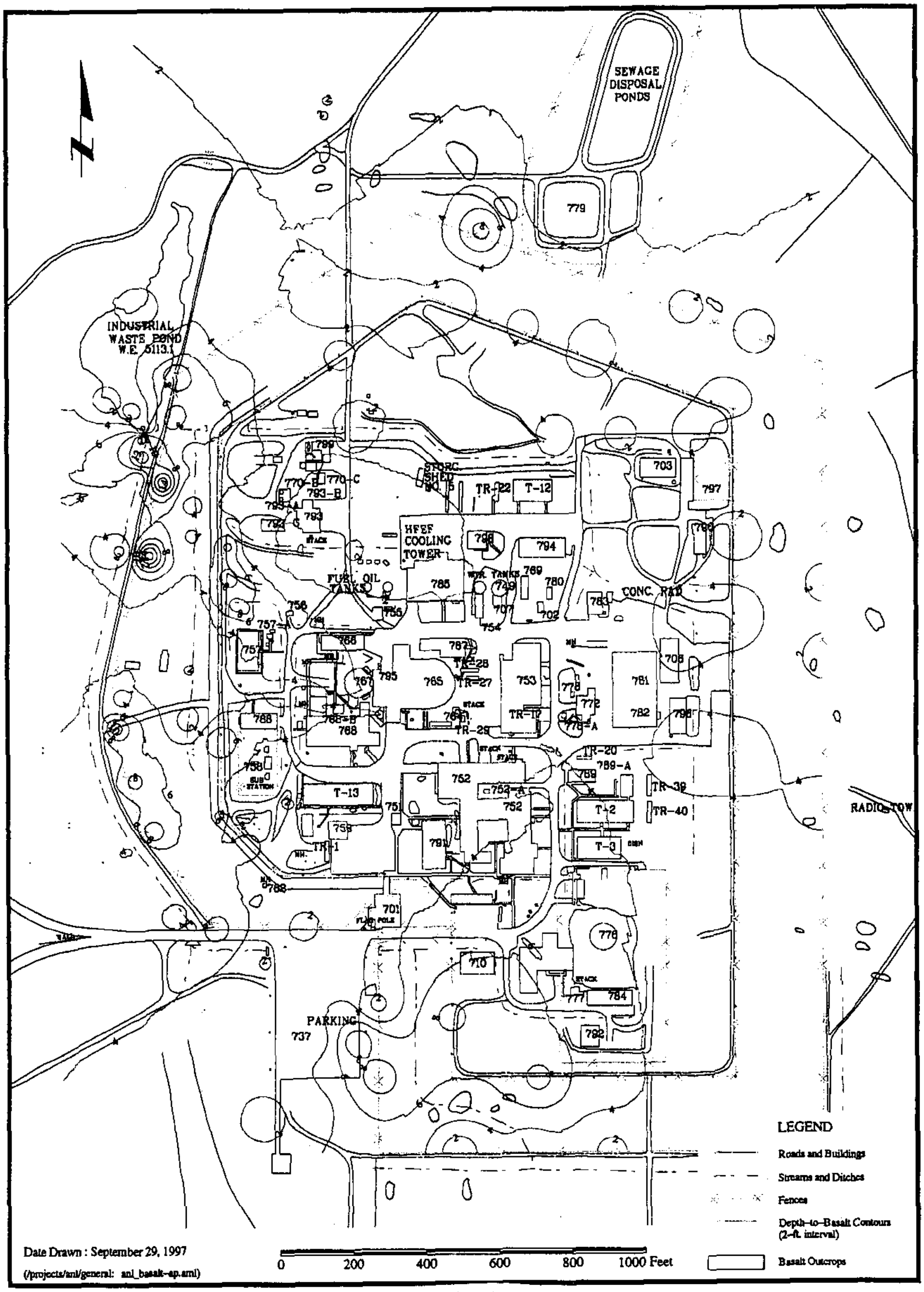

Figure 5-1. Thickness of Surficial Soils at ANL-W.

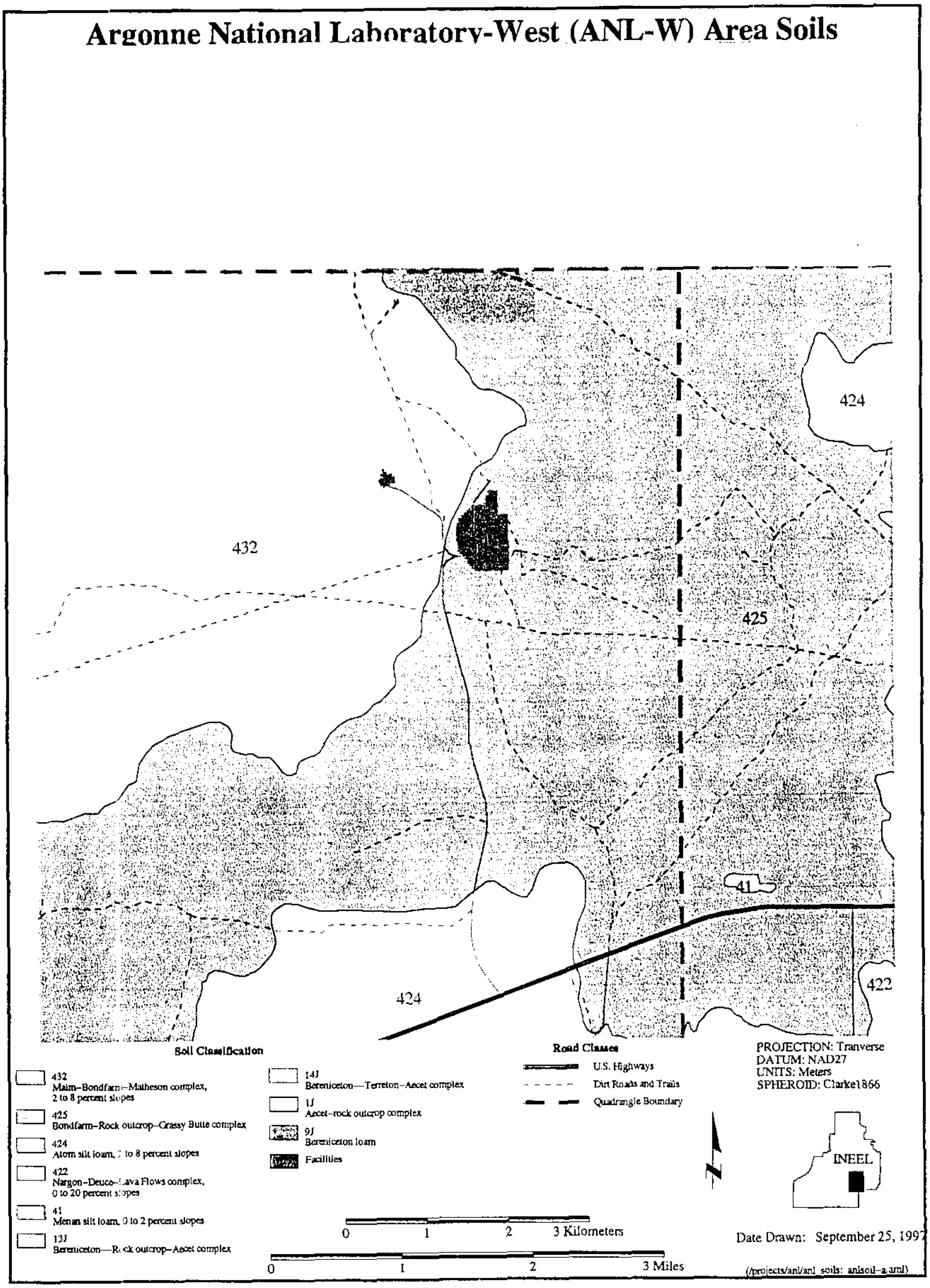

Figure 5-2. Map Showing General Soil Types Near ANL-W.

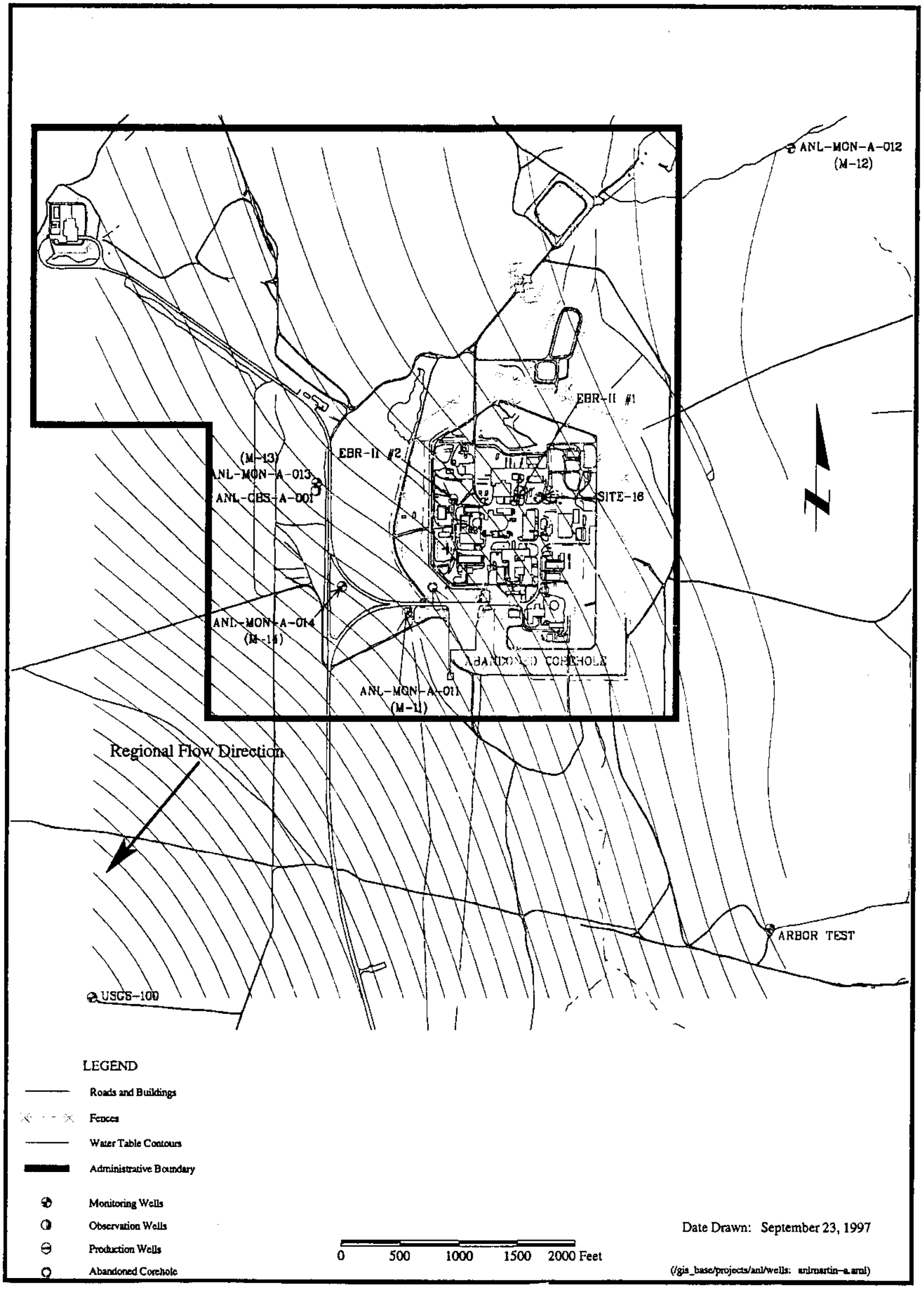

Figure 5-3. Location of Monitoring Wells Near ANL-W.

shown in Figure 2-1, these streams drain mountain watersheds to the north and west of the INEEL, including the Pioneer, Lost River, Lemhi, and Centennial mountain ranges. Land surface elevations rise from 4,774 feet in the basin to 12,656 feet on Borah Peak in the Lost River Range (Bennett 1990). Rainfall and snowmelt within the upper basin contribute to surface water, mainly during spring.

Most of the water in these streams is diverted upstream of the INEEL for irrigation or is lost to the subsurface due to high infiltration rates in the channel bed. During periods of high flow, some surface water may reach the INEEL. This water is approximately 15 miles west of the ANL-W facility. Because there are no permanent, natural surface water features near ANL-W, flooding is not a major concern. During rapid snowmelt events at ANL-W the Interceptor Canal and the Industrial Waste Pond receive surface water runoff. There is a diversion dam constructed south of the facility to handle these events. This dam has a headgate that, when closed, diverts water into the adjacent drainage ditch and eventually to the Interceptor Canal (ANL-09), and from there directly into the Industrial Waste Pond (ANL-01). No surface outflow leaves the INEEL, except for minor local slope runoff.

5.6 Ecology

The INEEL is located in a cool desert ecosystem characterized by shrub-steppe vegetation communities typical of the northern Great Basin and Columbia Plateau Region. The surface of the INEEL is relatively flat, with several prominent volcanic buttes and numerous basalt flows that provide important habitat for small and large mammals, reptiles, and some raptors. Juniper woodlands occur near the buttes and in the northwest portion of the INEEL; these woodlands provide important habitat for raptors and large mammals. Limited riparian communities exist along intermittently flowing waters of the Big Lost River and Birch Creek drainages.

Wildlife species present in and around ANL-W include birds, mammals, and reptiles that are associated with facilities, sagebrush-steppe, rock outcroppings, deciduous trees and shrubs, grasslands, and water (e.g., Industrial Waste Pond, Sewage Lagoons, and drainage ditches). Both terrestrial and aquatic species are potentially present. Sagebrush communities surrounding ANL-W typically support a number of species including sage grouse (*Centrocercus urophasianus*), sage sparrow (*Amphispiza belli*), and pronghorn (*Antilocapra americana*). Rock outcroppings associated with these communities also provide habitat for species such as bats, woodrats (*Neotoma cinerea*), and sensitive species such as the pygmy rabbit (*Brachylagus idahoensis*). Nearby grasslands serve as habitat for species including the western meadowlark (*Sturnella neglecta*) and mule deer (*Odocoileus hemionus*). ANL-W facility structures also provide important wildlife habitat. Buildings, lawns, ornamental vegetation, and ponds are utilized by a number of species such as waterfowl, raptors, rabbits, and bats. Lawns can be an important resource to species at WAG 9 (the source of the water for these lawns is from the ANL-W deep wells). No surface hydrology has existed to support fish. Current and future aquatic invertebrates are, however, supported by habitat provided by the Sewage Lagoons and the Industrial Waste Pond while they are receiving wastewaters from the facility.

The WAG 9 screening-level ecological risk assessment (SLERA) has also been conducted. The plant oxytheca (*Oxytheca dendroidea)* typically supports a number of species including sage grouse which was listed as a sensitive species with the U.S. Bureau of Land Management and the Idaho Native Plant Society/Idaho Fish and Game Conservation Data Center. Recently, the Environmental Science and Research Foundation conducted and published a biological assessment for WAG 9, which was organized by species groups and published.

5.7 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination for the WAG 9 sites that were retained for evaluation in the OU 9-04 Comprehensive RI/FS after completion of the Track 1 or Track 2 evaluation, and screening against the INEEL 95% upper confidence level (95% UCL) of background soil concentrations. The complete evaluation of the groundwater and the soils investigation is found in the OU 9-04 Comprehensive RI/FS. Only a brief summary of each is included in this ROD.

5.7.1 Nature and Extent of Groundwater Contamination

The GWSCREEN model (Rood 1994) was selected to perform the groundwater fate and transport calculations for contaminants at ANL-W. The model was designed to perform groundwater pathway screening calculations for the Track 1 and Track 2 process. It was also an appropriate model to use when site characterization data are lacking and little would be gained by the use of a more complex model.

A receptor grid was overlain on the source areas such that contributions to contaminant concentrations from all retained sites could be calculated at each receptor node. Each source area was modeled either as surface, buried sources, or pond as described in the GWSCREEN user's manual. Prior to modeling the groundwater exposure pathway, soil contamination data for each site was screened to eliminate low-risk contaminants and minimize the modeling input. Two inorganics, arsenic and chromium were retained as contaminants of potential concern. The groundwater concentrations for each of the retained sites were determined along with the cumulative effects of the overlapping plumes for similar contaminants from more than one release site. These groundwater concentrations for arsenic and chromium were then used to determine the associated human health risks of using the groundwater. Of all the potential contaminants of concern at the ANL-W facility, all of the contaminants including the arsenic and chromium were screened as contaminants of potential concern during the risk assessment. Thus, there is no nature and extent of groundwater contamination at ANL-W since no detrimental effects to the groundwater have occurred or are modeled to occur at the ANL-W facility from the contaminants identified during the evaluation of the CERCLA sites.

5.7.2 Nature and Extent of Soil Contamination

All of the 37 FFA/CO sites at WAG 9 were evaluated as part of the OU 9-04 Comprehensive RI/FS. The site screening was conducted using a four step process. The first step was to review all the information on a particular site to make sure no contaminant was overlooked. The second step was to identify any new sites or unevaluated sites. The third step was to eliminate sites that were found to be No Action based on the results of either the Track 1 or Track 2 assessment. The fourth step was to eliminate sites that had no source (i.e., no contaminants above 95% UCL of INEEL background). The result of the screening process resulted in thirty sites being screened from the detailed risk assessment process. The seven sites that were retained are: the Sanitary Sewage Lagoons (ANL-04), the EBR-II Leach Pit (ANL-08), the Industrial Waste Pond and Ditches A, B, and C (ANL-01), the Main Cooling Tower Blowdown Ditch (ANL-01A), the Interceptor Canal (ANL-09), the Industrial Waste Discharge Ditch (ANL-35), and the Main Cooling Tower Riser Pits (ANL-53).

Two of these seven WAG 9 sites were subdivided into smaller areas to facilitate a more accurate risk assessment based on actual physical characteristics, and water discharge rates. These two sites are the Interceptor Canal and the Industrial Waste Pond and Ditches A, B, and C. The Interceptor Canal was divided into two areas, the Interceptor Canal-Canal and -Mound areas. While the Industrial Waste Pond and associated Ditches A, B, and C has been subdivided into four areas the Industrial Waste Pond, Ditch A, Ditch B, and Ditch C. Thus, eleven areas were evaluated in the OU 9-04 Comprehensive RI/FS. The nature and extent of contamination in these eleven areas is described in sections 5.7.2.1 through 5.7.2.11 These eleven sites that were retained for evaluation in the OU 9-04 Comrehensive RI/FS are shown in Figure 5-4.

Appendix A of the Operable Unit 9-04 Comprehensive RI/FS contains all of the sampling information on these sites including: sample location maps, color concentration profiles, contaminant of concern statistics including sample size, mean, maximum, and 95% upper confidence limit (UCL) concentrations. Table 5-1 shows a summary of the FFA/CO site, the subarea, extent of contamination, contaminant of potential concern (COPC), and 95% UCL for the COPC for the eleven sites that were retained for evaluation in the OU 9-04 Comprehensive RI/FS.

Table 5-1. Extent of Contamination Soil in WAG 9 Sites Retained for Cleanup.

FFA/CO Site	Area Name	Width (ft)	Length (ft)	Depth (ft)	COPC	Conc. (mg/kg or pci/g)
ANL-01	Industrial Waste Pond	200	250	0.5	Cs-137	29.2
					Cr+3	10,260
					Hg	2.62
					Se	8.41
					Zn	5012
ANL-01	Ditch A	5	400	0.5	Hg	3.94
ANL-01	Ditch B	5	1,400	1.3	Cr+3	1,170
					Zn	3,020
ANL-01	Ditch C	5	500	2.5	Hg	0.29
ANL-01A	Main Cooling Tower Blowdown Ditch	6	700	2	Cr+3	709
					Hg	8.83
ANL-04	Sewage Lagoons	300	700	1	Hg	3.2
ANL-08	EBR-II Leach Pit					
ANL-09	Interceptor Canal-Canal	30	1,425	6	Cs-137	18
ANL-09	Interceptor Canal-Mound	20	500	4	Cs-137	30.53
ANL-35	Industrial Waste Lift Station Discharge Ditch	4	500	1	Ag	352
ANL-53	Main Cooling Tower Riser Pits	6	10	1.5	As	76
					Cr+3	1,717
					Pb	4,725
					Hg	0.78

5.7.2.1 Industrial Waste Pond

The Industrial Waste Pond (ANL-01) is an unlined, approximately 1.2-ha (3-acre) evaporative seepage pond fed by the Interceptor Canal and site drainage ditches. The pond was excavated in 1959, obtained a maximum water depth of about 4 m (13 ft) in 1988, and is still in use today. During this time, the Cooling Tower Blowdown ditches have been rerouted several times. ANL-W auxiliary cooling tower blowdown ditches convey industrial wastewater from the EBR-II Power Plant and the Fire Station (Bldgs. 768 and 759) to the Industrial Waste Pond. The Industrial Waste Pond was originally included with the Main Cooling Tower Blowdown Ditch (ANL-01A) as a Land Disposal Unit under the RCRA Consent Order and Compliance Agreement on the basis of potentially corrosive liquid wastes discharged with the cooling tower effluent. However, ANL-W conducted a field demonstration with the EPA and State of Idaho representatives in attendance in July 1988 that showed that any potentially corrosive wastes discharged to the Industrial Waste Pond were naturally neutralized in the Main Cooling Tower Blowdown Ditch before reaching the Industrial Waste Pond. On that basis, EPA removed the Industrial Waste Pond as a Land Disposal Unit and re-designated it as a Solid Waste Management Unit. Therefore, this site is still under the regulatory authority of RCRA in addition to being on the FFA/CO and under the regulatory authority of CERCLA.

DOE anticipates that the Industrial Waste Pond will continue to be used for storm water disposal as well as future releases of liquid cooling water discharges from the Sodium Process Facility. The Sodium Process Facility cooling water discharges will average 100 gallons per minute and are anticipated to last for three years starting in the spring of 1998 and lasting until summer of 2002. These cooling water releases will be discharged to the surface drainage ditch on the North side of ANL-W and drain approximately 250 ft. west to the Industrial Waste Pond. The Sodium Process Facility is a permitted HWMA/RCRA facility and is scheduled for clean closure under RCRA.

Appendix A of the OU 9-04 Comprehensive RI/FS shows the sampling location plan map and the statistics for contaminant of concern (COC) by pathway for all samples collected from the Industrial Waste Pond. Soil and sediment samples were collected from the Industrial Waste Pond as part of four different investigations occurring from 1986 to 1994. Cesium-137 was retained as a COPC for humans while, four inorganic contaminants were retained as COPCs for the ecological receptors.

The cesium-137 and the four inorganics (trivalent chromium, mercury, selenium, and zinc) were present in the southern and eastern part of the Industrial Waste Pond with concentrations typically greatest for surface samples near the inlet pipe in the southern part of the Industrial Waste Pond . Samples were screened against the 95% UCL concentrations for grab samples at the INEEL and will be referred to as 95% UCL background. The highest number of metals above the 95% UCL background concentration were collected from location #101 with 11 metals exceeding background, then location # 97 with ten metals exceeding the 95% UCL background concentration. The maximum cesium-137 concentration was 57.91 pCi/g, while the 95% UCL concentration was 29.2 pCi/g. For the trivalent chromium, mercury, selenium, and zinc the maximum concentrations were 11,400, 6.8, 37.9, and 5,850

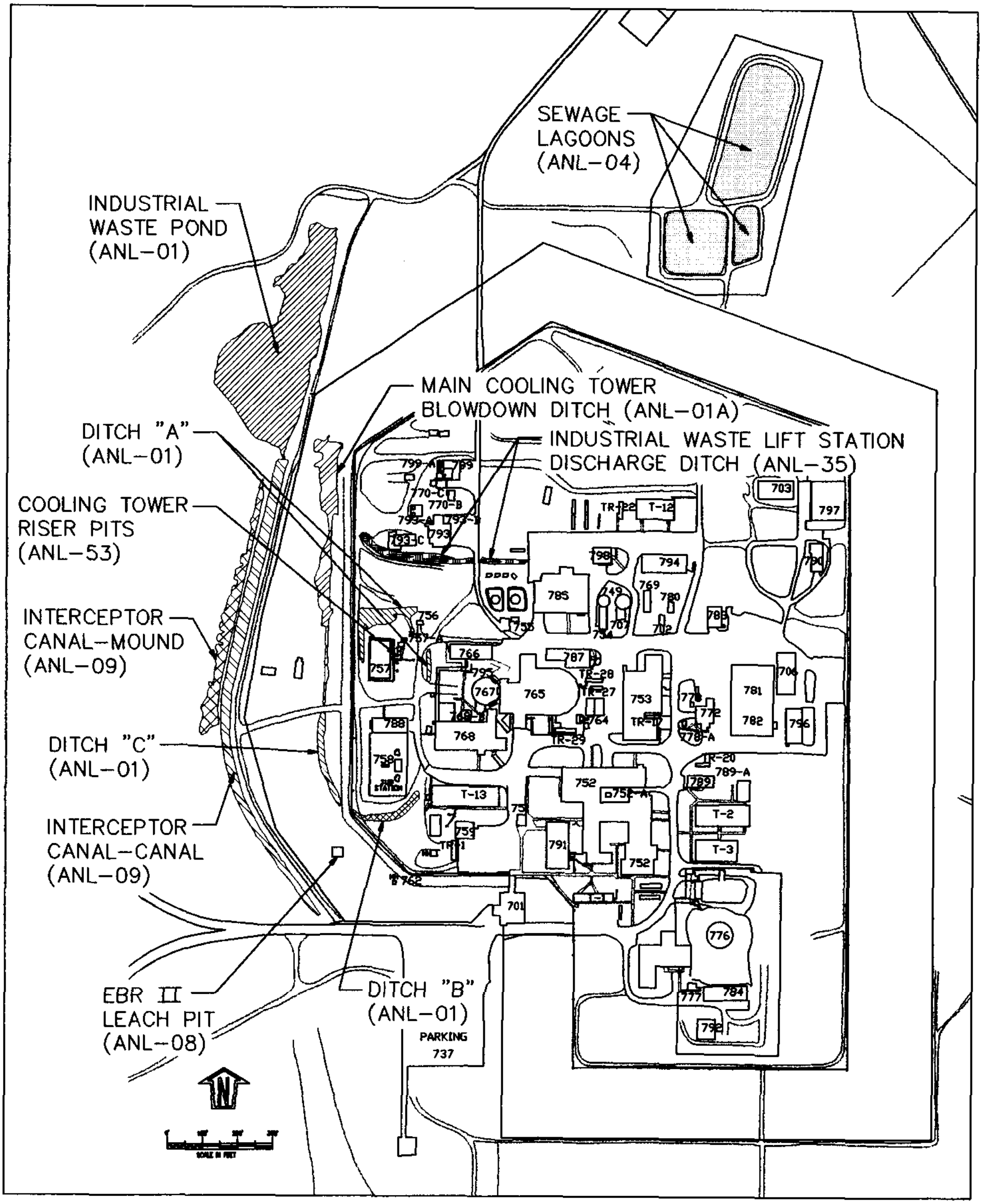

Figure 5-4. Eleven Areas Retained for Evaluation in RI/FS.

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mg/kg and the UCL values were 1,30, 2.62, 8.41, and 8.41 mg/kg, respectively. Therefore, the horizontal extent of contamination is the dimensions of both the southern and eastern part of the Industrial Waste Pond 200 feet wide and 250 feet long. While, the vertical extent of contamination is in the upper 0.5 feet of sediments in the Industrial Waste Pond.

5.7.2.2 Ditch A

Ditch A conveyed industrial wastewater from the EBR-II Power Plant auxiliary cooling tower to the Industrial Waste Pond. Ditch A is still being used today to transport storm water runoff as well as intermittent auxiliary cooling tower waters. Discharges to Ditch A flow into the Main Cooling Tower Blowdown Ditch and ultimately into the Industrial Waste Pond.

Soil samples were collected from Ditch A as part of two different investigations. These studies are the Chen Northern in 1988 and the 1994 ANL-W study. Appendix A of the OU 9-04 Comprehensive RI/FS shows the sampling location plan map, color intensity profile maps, and statistics for COC by pathway. In the 1988 Chen Northern study, eight soil samples were collected from three locations in the western part of the ditch. In the 1994 ANL-W study, 30 soil samples were collected from 11 locations throughout the entire length of the ditch.

Mercury was retained as a COPC for ecological receptors and was detected in 74% (27/38) of the samples analyzed. All of the mercury detections exceeded the upper limit of the 95% UCL background concentration (0.074 mg/kg). The source of the mercury is most likely from mercuric chloride used as a wood preservative in the cooling tower or from a neutron absorber in the power plant which is being decommissioned. The maximum detected concentration of 4.1 mg/kg was detected at location #10W in the surface sample (0 to 6 inches). While, the UCL concentration for mercury in Ditch A was 3.94 mg/kg. In all but one instance, the surface samples at each location contained the highest concentrations of mercury with the exception of #26E. The mercury contamination in Ditch A is spread through the entire length with the highest concentrations near the intersection of the Main Cooling Tower Blowdown Ditch and Ditch A. The mercury concentrations also decrease with increasing depth with the highest concentrations in the surface 0 to 6 inch samples. Therefore, the extent of contamination is the dimensions of both the eastern and western part of Ditch A 5 feet wide and 400 feet long and the vertical extent contained to the surface soils 0 to 6 inches.

5.7.2.3 Ditch B

Ditch B was also used to transport storm water runoff as well as wastewater from the EBR-II Power Plant and the Fire Station (Bldgs. 768 and 759) to the Industrial Waste Pond. Only a small 125 feet portion of Ditch B is still being used today since the majority 1,275 feet of Ditch B was backfilled with clean soil to grade approximately 5-feet during the installation of a secondary security fence.

Soil samples were collected from Ditch B as part of three different investigations. Six soil samples were collected from the 1988 DOE study, 15 samples collected from the 1988 Chen-Northern study, and 10 samples in the 1994 ANL-W study. Appendix A of the OU 9-04 Comprehensive RI/FS shows the sampling location plan map, color intensity profile maps, and statistics for COC by pathway for the 1994 samples collected from Ditch B. The contaminant screening resulted in COPCs for humans and only two inorganics being retained as COPCs for the ecological receptors. These two inorganics are trivalent chromium and zinc. The extent of the inorganic contaminants are discussed below.

The contaminants in the covered portion of Ditch B have been screened from the risk assessment since the pathway was eliminated when the area was backfilled with clean soils. The open portion of Ditch B has chromium and zinc at concentrations that could pose unacceptable human and ecological risks. The maximum concentration of trivalent chromium and zinc are 4,530 and 3,020 mg/kg and the UCL concentrations are 1,306 and 1,460 mg/kg, respectively. The extent of the inorganic contaminants span the entire length of the open portion of Ditch B is 5 feet wide and 125 feet long. No stratification of inorganics was determined from the results in that portion of Ditch B and thus the total depth of the alluvium to the basalt of 0 to 1.3 feet is used to define the extent of contamination.

5.7.2.4 Ditch C

The Ditch C portion of the Industrial Waste Pond and associated ditches (ANL-01) was created in 1978 when a portion of Ditch B was backfilled. The water in Ditch C is the same as that in Ditch B mentioned in previous section. The discharge water going to Ditch B is rerouted via culvert under the security fence to Ditch C which drains to the Main Cooling Tower Blowdown Ditch and ultimately the Industrial Waste Pond. Ditch C is dimensions are approximately 5 x 500 x 2.5 feet deep. The contaminant screening resulted in mercury being retained as a COPC for the ecological receptors. The maximum mercury concentration was 0.83 mg/kg and the 95% UCL concentration was determined to be 0.29 mg/kg. The extent of the contamination was spread throughout the entire length of the ditch (5 x 500 feet) and the vertical extent of contamination was 2.5 feet deep.

5.7.2.5 Main Cooling Tower Blowdown Ditch

The Main Cooling Tower Blowdown Ditch (ANL-01A) runs north on the westside of the Main Cooling Tower and then north between the security fences to the Industrial Waste Pond. It is an unlined channel approximately 700 feet in length and 3 to 15 feet wide. From 1962 to 1996, the ditch had been utilized to convey industrial wastewater from the Cooling Tower to the Industrial Waste Pond. The main source of impurities to the Industrial Waste Pond were water treatment chemicals used for the regeneration of backwash waters from the ion exchange resin beds and remove minerals from cooling tower water used in the EBR-II steam system. From 1962 to July 1980, a chromate-based corrosion inhibitor was added to the Cooling Tower water and the blowdown contained significant quantities of hexavalent chromium. Ion exchange column regeneration discharges have occurred from 1962 to March 1986. Regeneration of these column is accomplished with sulfuric acid for cation columns and sodium hydroxide for anion columns.

In January 1986, a pH measurement of 1.86 was measured in the effluent discharged to the Main Cooling Tower Blowdown Ditch. This classified the liquid wastes as corrosive according to 40 CFR 261.22. The site was then classified as a Land Disposal Unit under RCRA. A temporary neutralization system was installed in March, and a permanent neutralization tank was installed in October 1986. A few discharges of regeneration water occurred, but they were in small batches and were monitored before discharge. Since October 1986, after the neutralization tank was installed, reagents are being neutralized in a tank prior to discharge to the ditch. DOE, along with EPA and IDHW WAG 9 managers, have determined that the Main Cooling Tower Blowdown Ditch is a RCRA Land Disposal Unit and will be remediated under the CERCLA process in accordance with the applicable substantive requirements of RCRA/Hazardous Waste Management Act (HWMA), if an unacceptable risk to human health or the environment. However, the FFA/CO has only adopted RCRA corrective action (3004 (u) & (v)), and not RCRA/HWMA closure. Therefor, upon completion of the remedial action, the DOE must receive approval from the IDHW Department of Environmental Quality director that the Main Cooling Tower Blowdown Ditch has been closed pursuant to RCRA/HWMA closure requirements.

Appendix A of the OU 9-04 Comprehensive RI/FS shows the sampling location plan map, color intensity profile maps, and statistics for COC by pathway for samples collected from the Main Cooling Tower Blowdown Ditch. Soil samples were collected from the Main Cooling Tower Blowdown Ditch as part of four different investigations occurring from 1987 to 1994. In 1987, one soil sample (EST-SED) was collected from the northern part of the ditch where a storm water discharge ditch flows into it. In 1988, four soil samples were collected from the different parts of the ditch. Three soil samples were collected from the west part of the ditch (C103B-S, C100B-S,D, and C73A-S), one sample was collected in the eastern portion of the ditch at the discharge point (B6B-S,D). In 1989, two soil samples (M-8 and M-10) were collected in the 145-foot interbed along the western portion of the ditch. Finally, in 1994, 35 samples were collected along the entire length of the ditch. The contaminant screening resulted in two inorganics; trivalent chromium and mercury at levels high enough be retained as a COPC for the ecological receptors.

Chromium concentrations were the highest in the outfall from the Cooling Tower. But, the entire length of the Main Cooling Tower Blowdown Ditch has concentrations of chromium above the 95% UCL background concentration levels for the INEEL surface soils. The analysis performed on the chromium was for the total chromium analysis. The chromium was release was almost exclusively in the trivalent form rather than the more toxic hexavalent form. But, to be conservative, DOE assumed that ten percent of the total chromium would be in the more toxic hexavalent form. The chromium concentrations almost exclusively decreased with increasing depth, and also decreased with increasing distance downstream of the cooling tower outfall. The maximum chromium concentration was 2,200 mg/kg and the UCL concentration was 1,306 mg/kg for the Main Cooling Tower Blowdown Ditch.

Forty-eight percent (22/46) of the mercury concentrations exceeded the upper limit of the 95% UCL background concentration (0.074 mg/kg) ranging from 0.08–13.4 mg/kg. The highest detected concentration was from the surface sample at location 9E. Mercury concentrations were highest in the eastern part of the ditch and typically decreased to less than one mg/kg in the subsurface samples except for one location. At location 11E, mercury concentrations were 2.8 mg/kg in the surface and 2.3 mg/kg in the subsurface sample. The maximum mercury concentration was 13.4 mg/kg and the UCL concentration was 8.83 mg/kg for the surface soils in the Main Cooling Tower Blowdown Ditch.

The extent of the contamination is mainly concentrated in the southern portion of the ditch near the cooling tower outfall. However, there are some concentrations greater than the upper limit of the 95% UCL background concentration for some metals in the northwestern part of the ditch. Therefore, the horizontal extent of contamination is the dimensions of both the eastern and western part of the Main Cooling Tower Blowdown Ditch 3 to 15 feet wide and 700 feet long. Because the width of the ditch varies from 3 to 15 feet, an average width of 6 feet will be used. The majority of the inorganic contaminants were concentrated in the top 6 inches of soils. However, some detections greater than the upper limit of the 95% UCL background concentration were made in some subsurface samples. Therefore, the vertical extent of contamination is assumed to be one-half the average depth to basalt 2 feet.

5.7.2.6 Sewage Lagoons

The sanitary Sewage Lagoons (ANL-04) are located at the Sanitary Sewage Treatment Facility, north of the ANL-W facility. Two lagoons were constructed in 1965, with a third built later in 1974. According to engineering drawings, the three sanitary sewage lagoons cover approximately two acres. Appendix B shows a figure of the three lagoons with dimensions of; (1) 150 × 150 × 7 feet, (2) 50 × 100 × 7 feet, and (3) 125 × 400 × 7 feet. The lagoons receive all sanitary waste waters originating at ANL-W, with the exception of the Transient Reactor Test Facility, Sodium Process Facility, and the Sodium Components Maintenance Shop. Sanitary waste discharged is from rest rooms, change facilities, drinking fountains, and the Cafeteria. The three lagoon bottoms are sealed with a 0.125 to 0.25-inch layer of bentonite and are situated approximately 640 feet above the groundwater. The Sewage Lagoons are still in use and will continue to be used for disposal of sanitary wastes for the next 35 years.

Between 1975 and 1981, photo processing solutions were discharged from the Fuel Assembly and Storage Building to the Sanitary Waste Lift Station, which discharges to the Sewage Lagoons. There has been no known radioactive or hazardous substances released into the Sewage Lagoons. Periodic sampling of the Sewage Lagoon and the radionuclide detector placed in the lift station (Sanitary Waste Lift Station-788) supplying the Sewage Lagoons document that no radioactive substances have been released.

The results of the contaminant screening indicated that one contaminant, mercury, should be retained as a COPC for the ecological receptors. The mercury concentrations were detected throughout all of the sludge 0 to 6 inch samples in the Sanitary Lagoons. The maximum mercury concentration in the Sewage Lagoons was 3.2 mg/kg and this value was used in place of the UCL concentration because of the small data set (eight samples).

5.7.2.7 EBR-II Leach Pit

The EBR-II Leach Pit is located between the inner and outer security fences in the southwest corner of the ANL-W facility. The Leach Pit was an irregularly shaped, unlined underground basin that was excavated with explosives into basalt bedrock in 1959. The Leach Pit was used to dispose of ANL-W liquid industrial waste including cooling tower blowdown, sanitary effluent, cooling condensates, and radioactive effluent, until 1973. The average annual discharge to the Leach Pit was approximately 9×10^4 gallons from 1960 to October 1973 containing a total of 10.4 curies of radioactivity. The majority of the sludge was removed during an interim action in December 1993, after which the bottom of the Leach Pit was lined with 5 to 7 cm (2 to 3 in.) of bentonite clay and backfilled to grade. The contaminant screening resulted in various radionuclides being retained for evaluation of the groundwater pathways for the human health risk assessment and no COPCs being retained for the ecological receptors.

The extent of the radionuclide contamination was the physical dimensions of the EBR-II Leach Pit since it was blasted into the basalt. The extent of the EBR-II Leach Pit is 18 x 40 x 0.1 feet since the sludge was removed in 1993 and no horizontal or vertical migration has been detected in coring and drilling activities around and through the Leach Pit. The predominant radionuclides retained are cesium-137, strontium-90, cobalt-60, and uranium-238.

5.7.2.8 Interceptor Canal-Canal

The canal portion was utilized to transport industrial waste to the Industrial Waste Pond and to divert spring runoff and other natural waters around the ANL-W facility for flood control. Between 1962 and 1975, two 4-in. pipes transported liquid industrial wastes and cooling tower effluent, to the Interceptor Canal. One line transported cooling tower blowdown water and regeneration effluent while the other line originated at the Industrial Waste Lift Station (Bldg. 760) and transported industrial wastes. Liquid radioactive wastes were discharged through the same line as the industrial wastes, but they were diverted to the EBR-II Leach Pit. Discharge of industrial wastes was discontinued in 1973, and discharge of cooling tower blowdown water was discontinued in 1975.

During clean out operations at the Interceptor Canal in October 1969, abnormal background radioactivity was detected. Additional radiation surveys in 1969, 1973, and 1975 indicated that the entire length of the Interceptor Canal was contaminated. Approximately 4,540 yd^3 of contaminated soil was identified and only 1,240 yd^3 was targeted for removal. Of this soil that was removed, approximately 182 yd^3 was disposed at the RWMC from 1975 to 1976, and remaining 1,058 yd^3 of contaminated soil was removed and stockpiled on site (this stockpiled soil was evaluated as part of the OU 10-06). The remaining soil, 3,300 yd^3 was left in the ANL-09-Mound and was investigated as part of the RI/FS process. Another survey conducted in 1993 indicated that two small areas had elevated readings above background.

The contaminant screening resulted in only cesium-137 being retained as a COPC for humans and no COPCs for the ecological receptors. The 95% UCL concentration for cesium-137 is 18 pCi/g and is fairly uniform throughout the entire length of the ditch. Thus, the extent of contamination is 30 x 1,425 x 6 feet.

5.7.2.9 Interceptor Canal-Mound

This section summarizes the analytical results for soil samples collected at the Interceptor Canal-Mound (ANL-09) area. The Interceptor Canal-Mound was formed when 1,384 m^3 (1,810 yd^3) of dredged material was placed on the bank of the Interceptor Canal. Soil samples from the Interceptor Canal Mound were only analyzed for radionuclides. Inorganic releases to the Interceptor Canal-Canal occurred after the canal was dredged and therefore would not be in the dredged piles. Surface soil samples 0 to 6 inches and a subsurface soil sample approximately 3 to 4 feet were collected at the ANL-09-Mound area. In addition, another subsurface soil sample was collected from approximately 5 to 6 feet at three sample locations (#356, #368, and #378). Subsurface soil samples were collected at a depth that corresponds to the bottom of the mound. The deeper subsurface samples were collected to determine if migration of contaminants has occurred. The contaminant screening resulted in only one radionuclide (cesium-137) being retained as a COPC for humans and no COPCs for ecological receptors.

The cesium-137 was detected at every sample location throughout the mound, with the highest detected concentration (52 pCi/g) at location M19. While the UCL concentration for the cesium-137 was 30.53 pCi/g. Therefore, the horizontal extent of the cesium-137 is defined as the entire length of the mound 500 $\times$ 20 feet. For the vertical extent of the cesium-137 contamination, there is a significant decrease in concentrations (approximately one order of magnitude) between the surface and subsurface samples. The maximum detected C-137 concentration in the subsurface sample was only 5.9 pCi/g.

Nevertheless, as this concentration is above the established background, the vertical extent of contamination will be 4 feet.

5.7.2.10 Industrial Waste Discharge Ditch

The Industrial Waste Lift Station Discharge Ditch (ANL-35), also known as the North Ditch, is located inside the ANL-W security fences. The ditch is approximately 500 feet in length with a bottom width of 3 to 4 feet. At any one time, there is approximately 2 to 3 inches of water in the ditch. The ditch receives industrial waste water, primarily cooling water and photo processing wastes (e.g., photo developers, fixers, and stabilizers, and acids), but also including several retention tank overflows that may contain ethanol, sodium hydroxide, and some radionuclides, from a variety of facilities at ANL-W. The ongoing and future discharges of these processing wastes are regulated under other EPA laws such as RCRA. The cleanup action specified in this ROD address only those past releases of these processing wastes.

Soil samples were collected from this site on three separate occasions. Three soil samples were collected during the 1989, DOE Survey, 17 soil samples were collected during the 1988 Chen Northern sampling, and an additional 19 soil samples were collected in 1994 by ANL-W. Soil samples from all three sampling efforts were collected and analyzed for organics, inorganics, radionuclides, and dioxin/furans. Appendix A of the OU 9-04 Comprehensive RI/FS shows the sampling location plan map, color intensity profile maps, and statistics for COC by pathway for all samples collected in 1994 from the Industrial Waste Lift Station Discharge Ditch. Sample collection depths for the 1994 study were 0 to 6 inches and 1.5 to 2 feet.

The results of the contaminant screening resulted in no COPCs for human and only one inorganic, silver being retained as a COPC for the ecological receptors. Silver was analyzed for in all three studies and was detected at 87% (33 of 39) of the sample locations with the highest detection (352 mg/kg) at #41. This sample location is located in the middle of the ditch. The maximum concentration was used in risk assessment as the UCL value because of the small data set and large standard deviation in the data. However, high concentrations were also detected at other locations grid 18, ND03, 15, 18, and 19. Therefore, the horizontal extent of contamination is defined as the entire length of the ditch. No trends on the vertical extent of contamination were detected for silver. Thus, the average soil depth on top of the basalt 1.0 foot was used to define the vertical extent of contamination. Thus, the extent of contamination at the Industrial Waste Lift Station Discharge Ditch is defined as 15 × 500 × 1 foot.

5.7.2.11 Main Cooling Tower Riser Pits

The Cooling Tower Riser Pits consist of four pits located approximately 10 feet east of the Main Cooling Tower. Each of the four pits is approximately 12 feet deep with 9 to 15 inches of soil covering the rock bottom. During winter shutdown periods of the Main Cooling Tower, the riser pipes were drained to prevent damage caused by freezing and the riser pits are used to collect this discharge. The contaminant screening indicated that four inorganics be retained as COPCs for human health risk assessment. The four inorganics are arsenic, trivalent chromium, lead, and mercury. The maximum concentrations of each of these inorganics are 76, 1,717, 4,725, and 0.78 mg/kg, respectively. The extent of contamination is the entire inside dimension of each of the riser pits and the total depth of soil above the basalt (i.e., 6 x 10 x 1.5 feet).

5.8 No Action Sites

Based on the process used to conduct the OU 9-04 Comprehensive RI/FS, these sites were screened from the risk assessment. The screening process included review of the previous information, review of the risks presented in either a Track 1 or Track 2 type document, and evaluation of the contaminant source, and pathway to a receptor. These sites are considered to be no action sites even under an unrestricted land use scenario and hence will not require 5 year reviews. These sites are described in short detail below, additional details on these sites can be found in the OU 9-04 Comprehensive RI/FS.

5.8.1 Operable Unit 9-01 Sites

This OU consists of ten sites (ANL-04, -019, -28, -29, -30, -36, -60, -61, -62, and -63) that were identified in the FFA/CO. These ten sites consisted predominantly of low hazard miscellaneous sites with small discharges or construction wastes. Of the ten OU 9-01 sites, only two sites (ANL-04 and -61) were retained for further evaluation in the OU 9-04 Comprehensive RI/FS. The OU 9-04 Comprehensive RI/FS indicates that only ANL-04, the ANL-W sewage lagoons, pose unacceptable risks to the environment as discussed earlier in this ROD. A brief history of the other nine OU 9-01 sites that do not pose unacceptable risk follows:

Sludge Pit West of T-7 (Imhoff Tank) (ANL-19)—The Imhoff Tank and sludge pit collected sanitary waste from the power plant (Bldg. 768), the Fuel Conditioning Facility (Bldg. 765), the Laboratory and Office building (Bldg. 752), and the Fire House (Bldg. 759). The Imhoff Tank was used to settle out the sanitary wastes from 1963 to 1966. No potential source of hazardous materials is known to be associated with this site.

EBR-II Sump (ANL-28)—The EBR-II Sump is a 660-gallons underground coated carbon steel tank, 5 feet in diameter by 4.5 feet in depth located off the southwest corner of the Power Plant (Bldg. 768). The Sump is believed to have been installed in the early 1970s and is currently in use. The tank is a centralized collection facility for auxiliary cooling tower blowdown, ion exchange regeneration effluent, and small quantities of laboratory chemicals from the water chemistry laboratory in the Power Plant before discharging via a pipe to the Main Cooling Tower Blowdown Ditch. Currently, the Power Plant is not operating, but minor volumes of water chemistry water are still being discharged to the Main Cooling Tower Blowdown Ditch. No potential source of hazardous materials is known to be associated with this site.

Industrial Waste Lift Station (ANL-29)—The Industrial Waste Lift Station receives wastes from three major facilities; the Lab and Office (Bldg. 752), the Zero Power Physics Reactor (Bldg. 774), and the Fuel Manufacturing Facility (Bldg. 704). The only contaminant of potential concern identified from process knowledge of water released to the Industrial Waste Lift Station is silver. A Track 1 investigation was originally performed for this site and, based on the above information, it was determined that the potential health risks are less than the lower limit of the NCP target risk range.

Sanitary Waste Lift Station (ANL-30)—The Sanitary Waste Lift Station (Bldg. 778) was built in 1965. It receives all sanitary waste originating at ANL-W, with the exception of the Transient Reactor Test Facilities (Bldgs. 720, 721, 722, 724, and T-15), the Sodium Process Facility operations trailer, and the Sodium Components Maintenance Shop (Bldg. 793). The only waste discharged to the lift station was silver from photographic film development. The maximum detected silver concentration of 68 mg/kg was less than the cleanup goal across all exposure pathways of 1,350 mg/kg.

TREAT Photo Processing Discharge Ditch (ANL-36)—The Transient Reactor Test Photo Processing Discharge Ditch is located approximately 20 feet northeast of and parallel to the Photo Lab (Bldg. 724) and the TREAT Office Building (Bldg. 721). Approximately 400 gallons of photo processing solutions are estimated to have been discharged to the ditch over the 2-year period from 1977 to 1979. The maximum detected silver concentration of 17 mg/kg was less than the cleanup goal across all exposure pathways.

Knawa Butte (ANL-60)—The Knawa Butte is located due north of the Hot Fuel Examination Facility (Bldg. 785) near the security fence. The butte was used as a construction refuse pile until September 1972 when a service request was made to renovate the existing pile and convert it to a doughnut-shaped mound. The butte consists primarily of clean soil and rock excavated from ANL-W facility basement construction. No potential source of hazardous constituents is known to be associated with this site.

EBR-II Transformer Yard (ANL-61)—The EBR-II Transformer Yard located south of the EBR-II Power Plant (Bldg. 768) is the site of PCB and diesel fuel contamination. The PCB contamination is due to historic (i.e., prior to 1978) leakage from four transformers. All four transformers were replaced and the majority of the contaminated soil was removed during a cleanup action from 1988 through 1992. An additional area of PCB contaminated soil adjacent to an underground diesel storage tank was identified for removal. The PCB contaminated soil and underground diesel storage tank were removed in the summer of 1997. Verification samples were collected after removal and show that the remaining PCB contamination was remediated to the cleanup goal levels

Sodium Boiler Building Hotwell (ANL-62)—The Sodium Boiler Building (Bldg. 766) condensate hotwell, was built in 1962, and is located north of the EBR-II Power Plant (Bldg. 768). This hotwell, which is identical to the EBR-II Power Plant condensate hotwell, receives water from the steam trap and condensate drains. Neither hazardous constituents (hydrazine and tritium) believed to have been present at the site were detected.

Septic Tank 789-A (ANL-63)—This septic tank is located approximately 60 feet northeast of the Equipment Building (Bldg. 789-A) and was believed to have been installed in the late 1950s. No potential source of hazardous materials is known to be associated with this site.

5.8.2 Operable Unit 9-02 Site

OU 9-02 consists of one site (ANL-08, EBR-II Leach Pit) identified in the FFA/CO. The EBR-II Leach Pit is located between the inner and outer security fences in the southwest corner of the ANL-W facility. The Leach Pit was an irregularly shaped, unlined underground basin that was excavated with explosives into basalt bedrock in 1959. The Leach Pit was used to dispose of ANL-W liquid industrial waste including cooling tower blowdown, sanitary effluent, cooling condensates, and radioactive effluent, until 1973. The average annual discharge to the Leach Pit was approximately 9×10^4 gallons from 1960 to October 1973 containing a total of 10.4 curies of radioactivity. The majority of the sludge was removed during an interim action in December 1993, after which the bottom of the Leach Pit was lined with 2 to 3 inches of bentonite clay and backfilled to grade. A risk assessment performed on the concentration of the contaminants in the basalt and in the remaining sludge indicates that the total potential risk is 6E-06 from ingestion of groundwater contaminated with beryllium and neptunium-237, which is at the lower limit of the NCP target risk range (i.e., 1E-06). A Track 2 Summary Report was completed and signed by the RPMs that recommended additional evaluation of the vadose zone below the Leach Pit in the OU 9-04 Comprehensive RI/FS.

5.8.3 Operable Unit 9-03 Sites

OU 9-03 consists of three sites (ANL-05, -31, and -34) that were identified in the FFA/CO. These three sites had all received potentially hazardous chemicals that required additional sampling in order to determine the risks to human health and the environment. Of the three OU 9-03 sites, all three are recommended for No Action based on results in the Track 2 Summary Report.

ANL Open Burn Pits 1, 2, and 3 (ANL-05)—Three abandoned open burn pits are located at ANL-W. The pits were initially used to burn construction wastes, such as paper and wood in the early 1960's. In addition, approximately 150 gallons of organic wastes from analytical chemistry operations were disposed in the burn pits from 1965 to 1970. The organic wastes consisted primarily of toluene, xylene, hexane, isopropyl alcohol, butyl cellosolve, tributylphosphate, and mineral oil. A risk assessment was performed on the results of sampling and indicates that the potential risk from exposure to all contaminants detected is less than the lower limit of the NCP target risk range.

Industrial/Sanitary Waste Lift Station (ANL-31)—The Industrial/Sanitary Waste Lift Station (Bldg. 760) consists of an industrial and a sanitary lift station separated by a similar sump wall. The sanitary side is still used to pump sanitary wastes to the Sanitary Lagoons while the industrial side is inactive and has been backfilled with clean sand. Based on samples collected in the industrial side in 1995, the risk assessment indicated that several radionuclides pose a potential risk at the lower limit of the NCP target risk range for the current occupational scenario. Therefore in 1995, under a best management practice, ANL-W backfilled the industrial waste side with clean sand to remove the exposure route and removed the piping and contaminated soil from the Lift Station to the Meter House. Also under a best management practice the remaining 90 feet of the piping and soil from the Meter House to the EBR-II Leach Pit was removed in the summer of 1996. After the removals the verification samples collected showed that the remaining contaminants were below the cleanup goal concentrations.

Fuel Oil Spill by Building 755 (ANL-34)—ANL-34 is the site of a 50-gal spill of #5 fuel oil from an above ground storage tank. The spilled fuel oil occupied an area approximately 5 x 20 feet and was confined within the bermed area. A risk assessment was performed on the most mobile (i.e., naphthalene) and the most hazardous (i.e., benzene) constituents of the fuel oil. The risk assessment indicates that the risk would be below the lower limit of the NCP target risk range.

5.8.4 Operable Unit 9-04 Sites

OU 9-04 consists of five sites (ANL-01, -01A, -09, -35, and -53) that were identified in the FFA/CO. All five sites had received potentially hazardous chemicals that required additional sampling in order to determine the risks to human health and the environment. All of these sites were retained for detailed evaluation in the OU 9-04 Comprehensive RI/FS because they contained contaminants above the screening levels for either humans or the ecological receptors.

5.8.5 Operable Unit 10-06 Sites

Two WAG 10 sites at or near ANL-W that contain radionuclide-contaminated soils have been investigated in the OU 10-06 RI/FS. The two sites are the ANL-W—Windblown area and ANL-W—Stockpile site. These two sites are located within a mile of WAG 9 and are now included in the OU 9-04 Comprehensive RI/FS because the wastes had originated at ANL-W. Additional information on these two sites can be found in the 10-06 administrative record under INEL-94/0037 and INEL-95/0259. These two OU 10-06 sites are being incorporated into the OU 9-04 record of decision. The following two sections describe a short summary of the radionuclides detected and the associated risks.

ANL-W Windblown Area. This area actually consists of two areas, the windblown area around the remotely located TREAT reactor and the windblown area around the ANL-W facility. Soil samples were collected at both these facilities in 1993, and analytical results from soil samples collected by the Radiological and Environmental Sciences Laboratory (RESL, which is now called the Environmental Science & Research Foundation, Inc.) were used to evaluate risks from exposure to contaminants at the site. Risks for the current occupational exposure scenario and the future residential exposure scenario were within the NCP target risk range (i.e., 1E-04 to 1E-06). In addition to human health, risks to ecological receptors were also evaluated. This evaluation showed no unacceptable risks to populations of exposed ecological receptors.

ANL-W—Stockpile site. The ANL-W Stockpile is an abandoned borrow pit that was excavated as part of road building activities near ANL-W in the 1950s. The borrow pit is located on the west side of the ANL-W entrance road and is approximately 300 ft long and 200 ft wide. In 1975, ANL-W personnel used the borrow pit to dispose of approximately 1,058 cubic yards of low-level radionuclide contaminated soil from the ANL-W Interceptor Canal. The Operable Unit 10-06 Phase II field investigation was conducted at the ANL-W Stockpile to determine the nature and extent of radionuclide- and metal- contaminated soils within the stockpile. Radioactive hot spots were identified in the stockpile soil using field radiation survey instruments. Data were collected from three of the hot spots. The main radionuclide contaminant that contributed most of the risk was cesium-137, with concentrations up to 26,700 pCi/g. The human health risk assessment that was performed indicated that for the 100-year residential exposure the total risk is 5E-03, which is attributed to the external exposure (4E-03) and food crop ingestion (9E-04) from Cesium-137. In 1996, a non-time critical removal action was performed on the radionuclide contaminated stockpile site. The contaminated soils were removed using large excavation equipment and the soil was transported to the Warm Waste Pond at the Test Reactor Area. The preliminary remediation goal (PRG) for the Cesium-137 contaminated soil was 16.7 pCi/g and remaining soils were below this level. The remaining risks associated with this site is 1E-05 which is within the NCP target risk range.

6 SUMMARY OF SITE RISKS

6.1 Human Health Risk Evaluation

The human health risk assessment consists of two broad phases of analysis: (1) a site and contaminant screening that identified COPCs at retained sites, and (2) an exposure route analysis for each COPC. The exposure route analysis includes an exposure assessment, a toxicity assessment, and a risk characterization discussion. The OU 9-04 Comprehensive Baseline Risk Assessment includes an evaluation of human health risks associated with exposure to contaminants through soil ingestion, fugitive dust inhalation, volatile inhalation, external radiation exposure, groundwater ingestion, ingestion of homegrown produce, dermal adsorption of groundwater, and inhalation of water vapors because of indoor water use.

6.1.1 Contaminant Identification

Historical sampling data were used to identify contaminants present in surface soils at the WAG 9 sites. The list of contaminants was screened based on comparison with background concentrations determined for the INEEL, a detection frequency of less than 5%, and no evidence that the contaminant was released at the site, and whether the contaminant is routinely considered to be an essential nutrient. The complete contaminant of concern list for each of the sites retained for evaluation are shown in Tables 3-3 through 3-18 of the OU 9-04 Comprehensive RI/FS. Because substances that are essential nutrients can be toxic at high concentrations, this final screening step was applied only when the essential nutrient concentrations were less than 10 times the background concentrations.

6.1.2 Exposure Assessment

The human health exposure assessment quantifies the receptor intake of COCs for select pathways. The assessment consists of estimating the magnitude, frequency, duration, and exposure route of chemicals to humans.

6.1.2.1 Exposure Scenarios

Only those exposure pathways deemed to be complete, or where a plausible route of exposure can be demonstrated from the site to an individual, were quantitatively evaluated in the risk assessment. The populations at risk because of the exposure from waste at the ANL-W were identified by considering both the current and future land use scenarios.

The residential scenarios model a person living on the site 350 days a year for 30 years, beginning in 2097 (100 years from 1997). The 100-year residential scenario was selected for analysis because the DOE control of the INEEL lands is currently expected to last for at least 100 years. For purposes of the baseline risk assessment the assumption was made that future residents will construct 10-foot basements beneath their homes, and so the residents could be exposed to contaminants down to that depth.

Two occupational scenarios were evaluated as part of the baseline risk assessment for ANL-W. The assumptions used in the baseline risk assessment include nonintrusive daily industrial use without restrictions for 250 days per year for 25 years. Two time periods that were evaluated are starting now

(1997) and lasting 25 years. The second occupational scenario that was evaluated starts in 30 years (2027) and lasts for 25 years.

6.1.2.2 Quantification of Exposure

The following exposure pathways were considered applicable to the evaluation of human exposure to contaminants at the ANL-W sites: ingestion of soil, inhalation of fugitive dust, inhalation of volatiles, external radiation exposure, groundwater ingestion (residential scenario only), ingestion of homegrown produce (residential use only), and inhalation from indoor use of groundwater (residential scenario only).

Adult exposures were evaluated for all scenarios and pathways (external exposure; inhalation of dust; and ingestion of soil, groundwater, and foods); child exposures (0 to 6 years old) were considered separately only for the soils ingestion pathways in the residential scenarios. Children were included because children ingest more soil than adults, significantly increasing their exposure rate.

The exposure parameters used in the risk assessment were obtained from EPA and DOE guidance. The exposure parameter default values used in the risk assessment are designed to estimate the reasonable maximum exposure at a site. Use of this approach makes under-estimation of actual cancer risk highly unlikely. The exposure parameters used in the risk assessment were:

- ***All Pathways***

-Exposure frequency, residential	350 days/yr
-Exposure frequency, occupational	250 days/yr
-Exposure duration, occupational	25 yr
-Exposure duration, residential	30 yr

- ***External exposure pathway***

-Exposure time, residential	24 hr/day
-Exposure time, occupational	8 hr/day

- ***Soil ingestion pathway***

-Soil ingestion rate, residential-adult	100 mg/day
-Soil ingestion rate, residential-child	200 mg/day
-Soil ingestion rate, occupational	50 mg/day
-Exposure duration, residential-adult	24 hr
-Exposure duration, residential-child	6 hr

- ***Dust inhalation pathway***

-Inhalation rate	20 m^3 of air/day

- ***Groundwater ingestion pathway***

-Groundwater ingestion rate, residential	2 L/day

The contaminant exposure point concentrations evaluated in the baseline risk assessment were developed from site-specific sampling information. The ninety-five percent upper confidence level (95% UCL) of the mean concentration for the data set were calculated and depending on the size of the data set, either the 95% UCL or the maximum detected concentration was used as the concentration in the risk assessment calculations. This follows EPA guidance to determine the reasonable maximum exposure concentrations for contaminants at WAG 9.

6.1.3 Toxicity Assessment

A toxicity assessment was conducted to identify potential adverse effects to humans from contaminants at ANL-W. A toxicity value is the numerical expression of the substance dose-response relationship used in the risk assessment. Toxicity values (slope factors and reference doses) for the sites were obtained from EPA's Integrated Risk Information System (IRIS) database and EPA's *Health Effects Assessment Summary Tables*: Annual FY-95, 903-R-94-020, November 1995.

For the eleven sites that were retained for detailed analysis of human health risks, only one contaminant has been identified as a COPC in the Nature and Extent of Soil Contamination (Section 5.7.2 of this ROD). This contaminant is cesium-137 which is rapidly absorbed into the bloodstream of humans and is distributed thoughout the active tissures of the body. Metabolically, cesium-137 behaves as an analog of potassium. Its distribution throughout the body and the energetic beta and gamma radiation from its decay daughter, barium-137 metastable result in essentially whole-body irradiation.

6.1.4 Human Health Risk Characterization

Excess lifetime cancer risks are estimated by multiplying the intake level (developed using the exposure assumptions) by the slope factor. These risks are probabilities that are generally expressed in either scientific notation (1×10^{-6}) or exponential notation (1E-06). An excess lifetime cancer risk of 1E-06 indicates that, an individual has an additional one in one million chance of developing cancer over a lifetime as a result of site-related exposure to a carcinogen under the specific exposure conditions at a site. If an individual has a typical United States average cancer risk of 1 in 4, or 25 percent, then exposure to a carcinogen at the risk threshold concentration would raise his cancer risk to 0.250001 from 0.25. Excess cancer risks estimated below 1E-06 typically indicate that no further investigation or remediation is needed. Risks estimated between 1E-04 to 1E-06 indicate that further investigation or remediation may be needed. Risks estimated above the 1E-04 typically indicate that further action is appropriate. However, the upper boundary of the risk range is not a discrete line at 1E-04, although EPA generally uses 1E-04 in making risk management decisions. A specific risk estimate above 1E-04 may be considered acceptable if justified based on site-specific conditions.

The calculation of the noncarcinogenic hazard quotients were also calculated for the contaminants at WAG 9. The hazard quotients are ratios of a single substance exposure level to a reference dose for the same time duration. The tolerance ability for humans varies and the reference dose is based on the most susceptible individuals and then multiplied by the uncertainty factors (up to 10,000). This produces a very conservative value for non-cancer causing COC's . The hazard quotients are added together by exposure pathway to determine the hazard index.

For the sites that were retained for detailed analysis of the risks in the OU 9-04 Comprehensive RI/FS, ANL-W has prepared summary tables of the routes and calculated risks. These tables have been separated out by the contaminants contributing to each of the risk ranges (i.e., risks > 1E-04, risks between 1E-04 and 1E-06, and sites with HI greater than 1). The complete list of calculated carcinogenic and non-carcinogenic risk values is found in Appendix B of the OU 9-04 Comprehensive RI/FS. Each of these tables shows the release site, exposure scenario, exposure pathway, COC contributing to the risk, calculated risk or hazard quotient, and total exposure pathway excess cancer risk or hazard index. Table 6-1 shows only those sites with contaminants that have exposure pathway cancer risks greater than 1E-04. For contaminants that have not been identified as being a carcinogen the contaminant may still pose health risk to humans. The sites and contaminants with exposure pathway hazard index greater than 1 are shown in Table 6-2. Table 6-3 shows the sites and contaminants that have calculated exposure pathways cancer risks between 1E-04 and 1E-06. For the sites, contaminants, and exposure pathways with cancer risks less than 1E-06 have been screened from inclusion in this ROD.

6.1.5 Risk Management

The risk management process is used to formally document decisions that have been made by ANL-W, the EPA, and IDHW project managers to determine validity of the risk assessment to the actual site conditions. The baseline risk assessment results tend to be very conservative and are based on the EPA's default exposure parameters. These default exposure parameters tend to overestimate the exposure for a small site on the INEEL. The risk management section (5.11) of the OU 9-04 Comprehensive RI/FS described the 5 screening steps used by WAG 9 to determine which sites really pose unacceptable risks to human health or the environment. The five steps are: (1) elimination of sites with carcinogenic risk less than 1E-06; (2) elimination of sites with carcinogenic risks between 1E-04 and 1E-06, a risk management decision; (3) elimination of sites that the COC or exposure pathway has been eliminated; (4) elimination of contaminants at or below ANL-W specific background concentrations; and finally (5) elimination of sites with hazard quotients less than 1. Based on the risk management evaluation process, the human health evaluation resulted in three areas with unacceptable risks to human health. These three areas are the Industrial Waste Pond (ANL-01), the Interceptor Canal-Canal (ANL-09) and the Interceptor Canal-Mound (ANL-09). The contaminants, pathway, and risks for these three areas are shown in Table 6-4.

6.1.6 Human Health Risk Uncertainty

Many of the parameters used to calculate risks in the WAG 9 Baseline Risk Assessment and Ecological Risk Assessment (ERA) have various uncertainties associated with them. For example, limitations in site sampling produce some uncertainty associated with the extent of contamination at most of the WAG 9 sites. Limitations in the characterization of the WAG 9 physical environment produce some uncertainty associated with fate and transport properties of WAG 9 contaminants. To offset these uncertainties, parameter values were selected for use in the Baseline Risk Assessment and ERA so that the assessment's results would present an upper bound, yet reasonable, estimate of WAG 9 risks.

Table 6-5 shows risk assessment parameter, the uncertainties associated with it, and the effect on the risk. Uncertainties in analytical data include collection and evaluation are produced by variability in observed concentrations due to sampling design and implementation, laboratory analysis methods, seasonality, contaminant level variation, and natural concentration variation. Toxicity assumption uncertainties are inherent due to the nature of collecting toxilogical information from animal studies and relating those to humans. Other toxilogical uncertainties are encountered when uncertainty factors and modifying factors are used in derivation of the slope factors and reference doses. The exposure assessment uncertainties are produced by characterizing transport, dispersion, establishment of exposure settings, and derivation of chronic intakes. Contaminant modeling uncertainties are encountered when

Table 6-1. Exposure sites with human health risks greater than 1E-04.

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Cancer Risk	Exposure Pathway Cancer Risk	Justification for Screening (Step #)
ANL-01-IWP	0-25-year Occupational	External Radiation Exposure	Cs-137	8E-04	9E-04	NA
	30-55-year Occupational	External Radiation Exposure	Cs-137	4E-04	5E-04	NA
	100-year Residential	External Radiation Exposure	Cs-137	1E-04	4E-04	NA
ANL-09-Canal	0-25-year Occupational	External Radiation Exposure	Cs-137	5E-04	5E-04	3
	30-55-year Occupational	External Radiation Exposure	Cs-137	2E-04	2E-04	3
ANL-09-Mound	0-25-year Occupational	External Radiation Exposure	Cs-137	8E-04	8E-04	NA
	30-55-year Occupational	External Radiation Exposure	Cs-137	4E-04	4E-04	NA
	100-year Residential	External Radiation Exposure	Cs-137	1E-04	1E-04	NA
ANL-61A	100-year Residential	Ingestion of Soil	PCBs	6E-04	6E-04	3
	1,000-year Residential	Ingestion of Soil	PCBs	6E-04	6E-04	3
	100-year Residential	Ingestion of Homegrown Produce	PCBs	2E-04	2E-04	3
	1,000-year Residential	Ingestion of Homegrown Produce	PCBs	2E-04	2E-04	3
All WAG 9 sites (Cum Pathway)	100- and 1,000-year Residential	Ingestion of Groundwater	Arsenic	3E-04	3E-04	4
	100- and 1,000-year Residential	Inhalation of vapors from indoor water use	Arsenic	1E-03	1E-03	4

Table 6-2. Contaminant hazard index greater than 1 for OU 9-04 exposure sites, scenarios, and pathways.

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Excess Hazard Quotient	Exposure Pathway Hazard Index	Justification for Screening (Step #)
ANL-01-IWP	100- and 1,000 year Residential	Ingestion of Soil	Arsenic Chromium (VI)	0.3 0.8	1	4
		Ingestion of Homegrown Produce	Zinc Mercury	0.4 0.5	1	5
ANL-01-Ditch A	100- and 1,000 year Residential	Ingestion of Homegrown Produce	Zinc Mercury	0.1 0.9	1	5
ANL-01-Ditch B	100- and 1,000 year Residential	Ingestion of Homegrown Produce	Zinc Mercury	0.8 0.5	1	5
All WAG 9 sites (Cumulative Pathway)	100- and 1,000 year Residential	Ingestion of Groundwater	OCDD 2,4,5-TP (silvex) Antimony Arsenic Cadmium Fluoride Selenium Zinc	3E-01 2E-01 2E-01 1E+00 6E-01 1E+00 2E-01 2E-01	5	4 & 5

Table 6-3. Exposure sites with risks greater than 1E-06 and less than 1E-04.

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Cancer Risk	Exposure Pathway Cancer Risk	Justification for Screening (Step #)
Main Cooling Tower Blowdown Ditch (ANL-01A)	0-25- and 30-55-year Occupational	Ingestion of Soil	Arsenic	1E-05	1E-05	2
	0-25- and 30-55-year Occupational	External Radiation Exposure	U-238	2E-06	2E-06	2
	100-year Residential	Ingestion of Soil	Arsenic	5E-05	5E-05	2
	100-year Residential	External Radiation Exposure	U-238	4E-06	4E-06	2
	100 Residential	Ingestion of Homegrown Produce	Arsenic	5E-06	5E-06	2
Industrial Waste Pond (ANL-01)	0-25- and 30-55-year Occupational	Ingestion of Soil	Arsenic	5E-06	5E-06	2
	0-25- Occupational	External Radiation Exposure	Co-60	6E-06	9E-04	2
	100-year Residential	Ingestion of Soil	Arsenic	7E-05	7E-05	2
	100-year Residential	Ingestion of Homegrown Produce	Arsenic	8E-06	8E-06	2
Ditch A (ANL-01)	0-25- and 30-55-year Occupational	Ingestion of Soil	Arsenic	4E-06	4E-06	2
	0-25- and 30-55-year Occupational	External Radiation Exposure	U-238	5E-06	5E-06	2

Figure 6-3. Continued.

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Cancer Risk	Exposure Pathway Cancer Risk	Justification for Screening (Step #)
	100-year Residential	Ingestion of Soil	Arsenic	3E-05	3E-05	2
	100-year Residential	External Radiation Exposure	U-238	9E-06	9E-06	2
	100-year Residential	Ingestion of Homegrown Produce	Arsenic	4E-06	4E-06	2
Ditch B (ANL-01)	0-25- and 30-55-year Occupational	Ingestion of Soil	Arsenic	2E-06	2E-06	2
	100-year Residential	Ingestion of Soil	Arsenic	2E-05	2E-05	2
	100-year Residential	Ingestion of Homegrown Produce	Arsenic	3E-06	3E-06	2
Ditch C (ANL-01)	0-25- and 30-55-year Occupational	Ingestion of Soil	Arsenic	2E-06	2E-06	2
	0-25- Occupational	External Radiation Exposure	Co-60 U-238	1E-06 2E-05	2E-05	2 2
	30-55-year Occupational	External Radiation Exposure	U-238	2E-05	2E-05	2
	100-year Residential	Ingestion of Soil	Arsenic U-238	2E-05 2E-06	2E-05	2 2
	100-year Residential	External Radiation Exposure	U-238	3E-05	3E-05	2
	100-year Residential	Ingestion of Homegrown Produce	Arsenic	3E-06	3E-06	2

Figure 6-3. Continued.

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Cancer Risk	Exposure Pathway Cancer Risk	Justification for Screening (Step #)
Interceptor Canal- Canal (ANL-09)	0-25- and 30-55-year Occupational	Ingestion of Soil	Arsenic	3E-06	3E-06	2
	0-25-year Occupational	External Radiation Exposure	Co-60	2E-06	5E-04	2
	100-year Residential	Ingestion of Soil	Arsenic	3E-05	3E-05	2
	100-year Residential	External Radiation Exposure	Cs-137	8E-05	8E-05	2
	100-year Residential	Ingestion of Homegrown Produce	Arsenic	3E-06	3E-06	2
Interceptor Canal-Mound (ANL-09)	0-25-year Occupational	External Radiation Exposure	Co-60 U-238	1E-05 2E-06	8E-04	2 2
	30-55-year Occupational	External Radiation Exposure	U-238	2E-06	4E-04	2
	100-year Residential	External Radiation Exposure	U-238	3E-06	1E-04	2
Industrial Waste Liftstation Discharge Ditch (ANL-35)	0-25-year Occupational	External Radiation Exposure	Co-60 Cs-137 U-238	2E-06 5E-05 2E-06	6E-05	2 2 2

Figure 6-3. Continued.

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Cancer Risk	Exposure Pathway Cancer Risk	Justification for Screening (Step #)
	30-55-year Occupational	External Radiation Exposure	Cs-137	3E-05		2
			U-238	2E-06	3E-05	2
	100-year Residential	External Radiation Exposure	U-238	3E-06		2
			Cs-137	9E-06	1E-05	2
Cooling Tower Riser Pits-South (ANL-53)	0-25- and 30-55-year Occupational	Ingestion of Soil	Arsenic	2E-06	2E-06	2
	100-year Residential	Ingestion of Soil	Arsenic	2E-05	2E-05	2
	100-year Residential	Ingestion of Homegrown Produce	Arsenic	3E-06	3E-06	2
EBR-II Transformer Yard (ANL-61A)	0-25- and 30-55-year Occupational	Ingestion of Soil	PCB's	7E-05	7E-05	2
All WAG 9 sites (Cumulative Pathway)	100- year Residential	Ingestion of Groundwater	Bis(2-Ethylhexyl) Phthalate	4E-06		2
			Methylene Chloride	7E-06	1E-06	2
	100- year Residential	Inhalation of water vapors from Indoor Water Use	Methylene Chloride	1E-06	1E-06	2

Figure 6-3. Continued.

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Cancer Risk	Exposure Pathway Cancer Risk	Justification for Screening (Step #)
TREAT Windblown Area (10-06)	30- year Residential	Ingestion of Homegrown Produce	Sr-90	2E-06	2E-06	2
Stockpile Soil (10-06)	100-year Residential	External exposure	Cs-137	1E-05	1E-05	2
All WAG 9 sites (Cumulative Pathway)	100- year Residential	Ingestion of Groundwater	Bis(2-Ethylhexyl) Phthalate	4E-06		2
			Methylene Chloride	7E-06	1E-06	2
	100- year Residential	Inhalation of water vapors from Indoor Water Use	Methylene Chloride	1E-06	1E-06	2

Table 6-4. Sites retained for evaluation in the feasibility study because of human health risks.

ANL-W Release Site	Exposure Scenario	Exposure Pathway	Contributing COC	Calculated Cancer Risk	Exposure Pathway Cancer Risk	Justification for Screening (Step #)
ANL-01-IWP	0-25-year Occupational	External Radiation Exposure	Cs-137	8E-04	9E-04	NA
	30-55-year Occupational	External Radiation Exposure	Cs-137	4E-04	5E-04	NA
	100-year Residential	External Radiation Exposure	Cs-137	1E-04	4E-04	NA
ANL-09-Mound	0-25-year Occupational	External Radiation Exposure	Cs-137	8E-04	8E-04	NA
	30-55-year Occupational	External Radiation Exposure	Cs-137	4E-04	4E-04	NA
	100-year Residential	External Radiation Exposure	Cs-137	1E-04	1E-04	NA

default values are used instead of actual site conditions and model outputs cannot be verified with actual data.

Table 6-5. Uncertainties associated with the human health risk assessment.

Area	Uncertainties	Effect on Risk
Sampling and Analysis	A representative concentration may not have been obtained where limited sampling was performed.	Overestimate or Underestimate
Concentration Terms	95% UCL values were used in Risk Assessment.	Overestimate
	ANL-W used one-half the detection limit when the constituent is not detected.	Overestimate
Fate and Transport	Use of conservative generic modeling parameters may not be truly representative of ANL-W site conditions.	Overestimate
	Distribution coefficient values have wide ranges for various soil types.	Overestimate
GWSCREEN Modeling	GWSCREEN input parameters (i.e., contaminant solubility limit, distribution coefficient (k_d), and infiltration rate are considered conservative, but contain some uncertainty.	Underestimate or Overestimate
	Maximum source term concentrations are assumed for the entire volume modeled for each site.	Overestimate
Exposure Assessment	Assumes residence could be established in area that are uninhabitable due to physical or administrative limitations.	Overestimate
	Default exposure values assume maximum possible exposure times, particularly for the occupational scenario where exposure times were 8 hours per day rather than more realistic time of a maximum of a few hours a week.	Overestimate
	The dermal absorption pathway was not included in the risk assessment calculations.	Underestimate
Toxicity Assessment	Use of parent nuclide slope factor plus daughter (+D) rather than adding slopes for each radionuclide.	Underestimate
	Extrapolation of values from nonhuman studies to humans, from high doses to low doses.	Overestimate or Underestimate
	Chromium was assumed to be 10% hexavalent and 90% trivalent form based on worst case studies at ANL-W.	Overestimate
	Route-to-route extrapolations are used.	Overestimate or Underestimate
Risk Characterization	Risks are added across constituents and pathways, although they may not affect the same target organ or mechanisms of damage.	Underestimate or Overestimate
	Assumption that constituents are evenly distributed at the 95% UCL concentration.	Overestimate
	Toxicity values for some constituents such as chromium and silver are based on industrial conditions.	Overestimate

6.2 Ecological Evaluation

The ecological assessment for ANL-W is a quantitative evaluation of the potential effects of the sites on plants and animals other than people and domesticated species. A quantitative ecological assessment is planned in conjunction with the INEEL-wide comprehensive RI/FS scheduled for 1999. The assessment endpoints developed around the protection of biota represented by functional groups and individual threatened and endangered and Category 2 species known to exist at ANL-W. Assessment endpoints were defined for ANL-W were in the INEEL ERA Guidance Manual (VanHorn et al., 1995) and incorporate the suggested criteria for developing assessment endpoints, including ecological relevance and policy goals (EPA 1992).

The selection of measurement endpoints for the ANL-W flora and fauna were not surveyed directly. Rather, published references were used as the primary sources of ecological and toxicological data from measurement endpoints were derived. Values extracted from these references were used to calculate the ecological based screening levels for all ecological receptors and to develop the toxicity reference values for the contaminants.

The measurement endpoints are the modeled dose as compared to the toxicity reference values (TRVs) for each contaminant for each receptor or functional group. The dose was divided by the TRV to produce a hazard quotient (HQ) for each contaminant and receptor of concern. The HQ is ultimately used to measure whether the assessment endpoint has been attained, that is, no indication of possible effects is determined (i.e., HQs are less than target value for all receptors for each contaminant). This target value for the ecological HQs was established to be 10 times the HQ of the 95% UCL for the INEEL background.

This INEEL-wide ecological assessment provided an indication of the affect of INEEL releases in the ecology at a population level. In the area near ANL-W, there are no critical or sensitive habitats. Based on the present COCs and ecological information the quantitative eco-evaluation performed for this ROD. Six areas pose potentially unacceptable risks to the ecological receptors for up to five inorganics; chromium, mercury, selenium, silver, and zinc. Of these six areas, one also shows unacceptable human health risks. Table 6-6 lists the six areas, contaminants of concern, and corresponding mltiplication of the HQ above the INEEL background HQ for those sites that were retained for the ecological receptors.

6.2.1 Species of Concern

The only federally listed endangered species known to frequent the INEEL is the peregrine falcon. The status of the bald eagle in the lower 48 United States was changed from endangered to threatened in July 1995. Several other species observed on the INEEL are the focus of varying levels of concern by either federal or state agencies. Animal and avian species include the ferruginous hawk, the northern goshawk, the sharp-tailed grouse, the loggerhead shrike, the Townsend's big-eared bat, the pygmy rabbit, the gyrfalcon, the boreal owl, the flammulated owl, the Swainson's hawk, the merlin, and the burrowing owl. Plant species classified as sensitive include Lemhi milkvetch, plains milkvetch, wing-seed evening primrose, nipple cactus, and oxytheca. Table 6-6 shows the sites of concern along with the functional group identification number and a species common in the functional group.

Table 6-6. Sites that have unacceptable ecological risks, HQ, functional group, and species.

FFA/CO Site	Area Name / size (ft)	COC	Multiple of INEEL natural background HQ*	Functional Group	Common Species
ANL-01	Industrial Waste Pond / 200x250x0.5	Cr+3	200	Plants	Numerous
		Hg	30	(M222)	Merriams shrew
		Se	20	(M222)	Merriams shrew
		Zn	20	(AV232)	Red-winged blackbird
ANL-01	Ditch A / 5x400x0.5	Hg	50	(AV132)	Sora
ANL-01	Ditch B / 5x1,400x1.3	Cr+3	20	Plants	Numerous
		Zn	15	(AV232)	Red-winged blackbird
ANL-01A	Main Cooling Tower Blowdown Ditch / 6x700x2	Cr+3	15	Plants	Numerous
		Hg	120	(M222)	Merriams shrew
ANL-04	Sewage Lagoons / 300x700x1	Hg	40	(M222)	Merriams shrew
ANL-35	Industrial Waste Lift Station Discharge Ditch / 4x500x1	Ag	30	Plants	Numerous

* The agencies agreed that action would be taken on WAG 9 sites where the hazard quotient caused by a COC exceeded the hazard quotient cased by natural background concentrations by a factor of 10 or more.

6.2.2 Exposure Assessment

The WAG 9 ecological risk assessment (ERA) evaluated all the FFA/CO sites and determined that five sites have a potential source of contamination and/or a pathway to ecological receptors. These sites were evaluated using the general approach as discussed in VanHorn et al. (1995) and following guidelines proposed by EPA (EPA 1992). The results of the ERA evaluation of the remaining sites are presented as a range of hazard quotients (HQs) calculated for functional groups. Due to the uncertainty in the ERA methods, HQs are used only as an indicator of risk and should not be interpreted as a final indication of actual adverse effects to ecological receptors. In addition, DOE used the INEEL 95% UCL background concentrations for the inorganics which resulted in HQs greater than 1. Based on the conservative nature of the HQ calculations, DOE will only remediate those WAG 9 sites that have HQs that are at least 10 times the HQ calculated using the INEEL or ANL-W specific 95% UCL background concentration. Six areas; ANL-01, Ditch A, Ditch B, ANL-01A, ANL-04, and, ANL-35 were retained because of ecological risks.

6.2.3 Ecological Risk Uncertainites

Uncertainty is inherent in the risk assessment process. Principal sources of uncertainty lie within the development of an exposure assessment. Uncertainties inherent in the exposure assessment are associated with estimation of receptor ingestion rates, selection of acceptable HQs, variations in background inorganic concentrations, estimation of site usage, and estimation of plant uptake factors and bioaccumulation factors. Additional uncertainties are associated with the depiction of site characteristics, the determination of the nature and extent of contamination, and the derivation of Threshold Limit Values. All of these uncertainties likely influence risk to some extent. Table 6-7 shows risk assessment parameter, the uncertainties associated with the identified parameter, and the effect on the risk.

The uncertainties for the ecological risk assessment conducted for WAG 9 include the use of HQ as an indicator of risk. The HQ is a ratio of the calculated dose for a receptor from a COC to the toxicity reference value. These ratios provide a quantitative index of risk to define functional groups or individual receptors under assumed exposure conditions. A HQ less than the target value (i.e., typically 1) implies "low likelihood" of adverse effects from that contaminant. However, in many cases, INEEL background concentrations of inorganics produced HQ greater than 1. Thus, for WAG 9 the approach of using the ten times the background HQ was adopted in establishing the action levels.

6.3 Groundwater Risks

The GWSCREEN model was selected to perform the groundwater contaminant fate and transport calculations. The source areas were modeled individually instead of modeling a single composited site. Each source area was located according to its physical geographic location within the ANL-W facility and the contaminant specific plumes were added together to determine the maximum contaminant concentration. The maximum contaminant concentration for the groundwater was then used in the risk assessment calculations. The results of the cumulative evaluation of the groundwater indicate that arsenic and chromium are the only contaminants that pose a potentially unacceptable groundwater contaminant levels. The maximum arsenic and chromium concentrations for the future residents 100-years in the future were calculated. The chromium risk were less than 1E+06 and the arsenic resulted in a risk of 3E-04 for the ingestion of groundwater and 1E-03, for the inhalation of vapors from indoor water use. Both risk values for arsenic exceeded the upper limit of the National Contingency Plan level of 1E-04. The arsenic was determined to be from natural sources at the INEEL and screened as a contaminant of concern during the risk management process for these CERCLA sites at ANL-W. Additional information on the groundwater modeling and screening of arsenic as a contaminant of concern at ANL-W can be found in the OU 9-04 Comprehensive RI/FS Sections 5.4, 5.5, 5.6, 5.7, 5.8, and 5.11.2.4.

6.4 Basis for Response

The ANL-W OU 9-04 Comprehensive RI/FS evaluated the risks associated with the 37 sites from WAG 9 along with two sites from WAG 10. Together these 39 sites were evaluated to determine the risks to the current and future receptor scenarios. The following two paragraphs explain which sites pose unacceptable risks for the human health and ecological receptors.

Table 6-7. Uncertainties associated with the ecological risk assessment.

Area	Uncertainties	Effect on Risk
Sampling and Analysis	A representaitve concentration may not have been obtained where limited sampling was performed.	Overestimate or Underestimate
Concentration Terms	95% UCL values were used in Risk Assessment.	Overestimate
	ANL-W used one-half the detection limit when the constituent is not detected.	Overestimate
Fate and Transport	Use of conservative generic modeling parameters may not be truly representative of ANL-W site conditions.	Overestiamate
	Distribution coefficient values have wide ranges for various soil types.	Overestimate
Functional Groups	The functional groups were designed to assess a hypothetical species using input values that represent the greatest exposure of the combined functional group members.	Overestimate
Estimation of Ingestion Rates	Only a few of the intakes for the terrestrial receptors were based on ingestion rates found in literature. Most of the ingestion rates were calculated using allometric equations available in literature.	Overestimate or Underestimate
Estimation of Plant Uptake Factors	Few bioaccumulation factors and plant uptake factors are available in the literature. In the absence of literature values, ANL-W calculated bioaccumulation and plant uptake factors from information in Baes. 1994.	Overestimate or Underestimate
Estimation of Toxicity Reference Values	Various adjustment factors are incorporated to extrapolate toxicity from the test organism to other species.	Overestimate or Underestimate
Site Use Factors	Home range is not known for many species and therefore a default of 1.0 was used.	Overestimate
Hazard Quotients	Variations in INEEL background concentrations of inorganics were not accounted for when calculating the toxicity reference values and ultimately effect the Hazard Quotient value.	Overestimate

Eight areas at ANL-W have actual or threatened releases of hazardous substances, which, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment. These eight areas are; the Industrial Waste Pond (ANL-01), Ditch A (ANL-01), Ditch B (ANL-01), the Main Cooling Tower Blowdown Ditch (ANL-01A), the Sanitary Sewage Lagoons (ANL-04), the Interceptor Canal-Canal (ANL-09), the Interceptor Canal-Mound (ANL-09), and the Industrial Waste Station Discharge Ditch

(ANL-35). These eight areas with unacceptable human health or ecological risks are shown in Figure 6-1. A summary of the sites with actual or threatened releases of hazardous substances to humans or ecological receptors is shown in Table 6-8. These sites with unacceptable risks to humans and/or the ecological receptors are described in the following two paragraphs, respectfully.

The Baseline Risk Assessment (BRA) indicated that for the current and future occupational scenario, only one contaminant cesium-137, would produce an unacceptable risk to human health. The cesium-137 posed an unacceptable risk to both current and future occupational receptors and future residential receptors at two sites, the Industrial Waste Pond (ANL-01) and the Interceptor Canal-Mound (ANL-09). While the cesium-137 at the Interceptor Canal-Canal (ANL-09) site only poses an unacceptable risks for the current and future occupational receptors. The Interceptor Canal-Canal (ANL-09) risks will be mitigated for the current and future occupational receptors by implementation of the land use restrictions during the 100-year DOE control as defined in the in the land use assumptions. Thus, the Interceptor Canal-Canal (ANL-09) portion will only undergo implementation of standard operating procedures to reduce the risks to the occupational receptors to acceptable levels.

The results of the WAG 9 ERA indicate that of the 37 WAG 9 release sites and the 2 WAG 10 sites, only six areas produce potentially unacceptable risks for ecological receptors due to the presence of various inorganic contaminants. These six areas are; the Industrial Waste Pond, Ditch A, Ditch B (all from ANL-01), the Main Cooling Tower Blowdown Ditch (ANL-01A), the Sewage Lagoons (ANL-04), and the Industrial Waste Lift Station Discharge Ditch (ANL-35). The remaining sites that were evaluated as part of the OU 9-04 Comprehensive RI/FS had risks that were within the acceptable range of the National Contingency Plan. These sites are being mentioned here to formally document in this ROD that they require No Action.

None of the contaminants exceeded the hazard index of 1 for either the current or future occupational exposure route. The response actions selected in this ROD are designed to reduce the potential threats to human health and the environment to acceptable levels.

Table 6-8. Sites with unacceptable human health or ecological risks.

ANL-W Area /Site Code	Human Health Risk?	Ecological Risk?
Industrial Waste Pond / (ANL-01)	Yes*	Yes*
Ditch A / (ANL-01)	No	Yes
Ditch B / (ANL-0)	No	Yes
Main Cooling Tower Blowdown Ditch / (ANL-01A)	No	Yes
Sewage Lagoons / (ANL-04)	No	Yes
Interceptor Canal-Canal / (ANL-09)	Yes	No
Interceptor Canal-Mound / (ANL-09)	Yes	No
Industrial Waste Lift Station Discharge Ditch / (ANL-35)	No	Yes

* This is the only site with both human health and ecological risks.

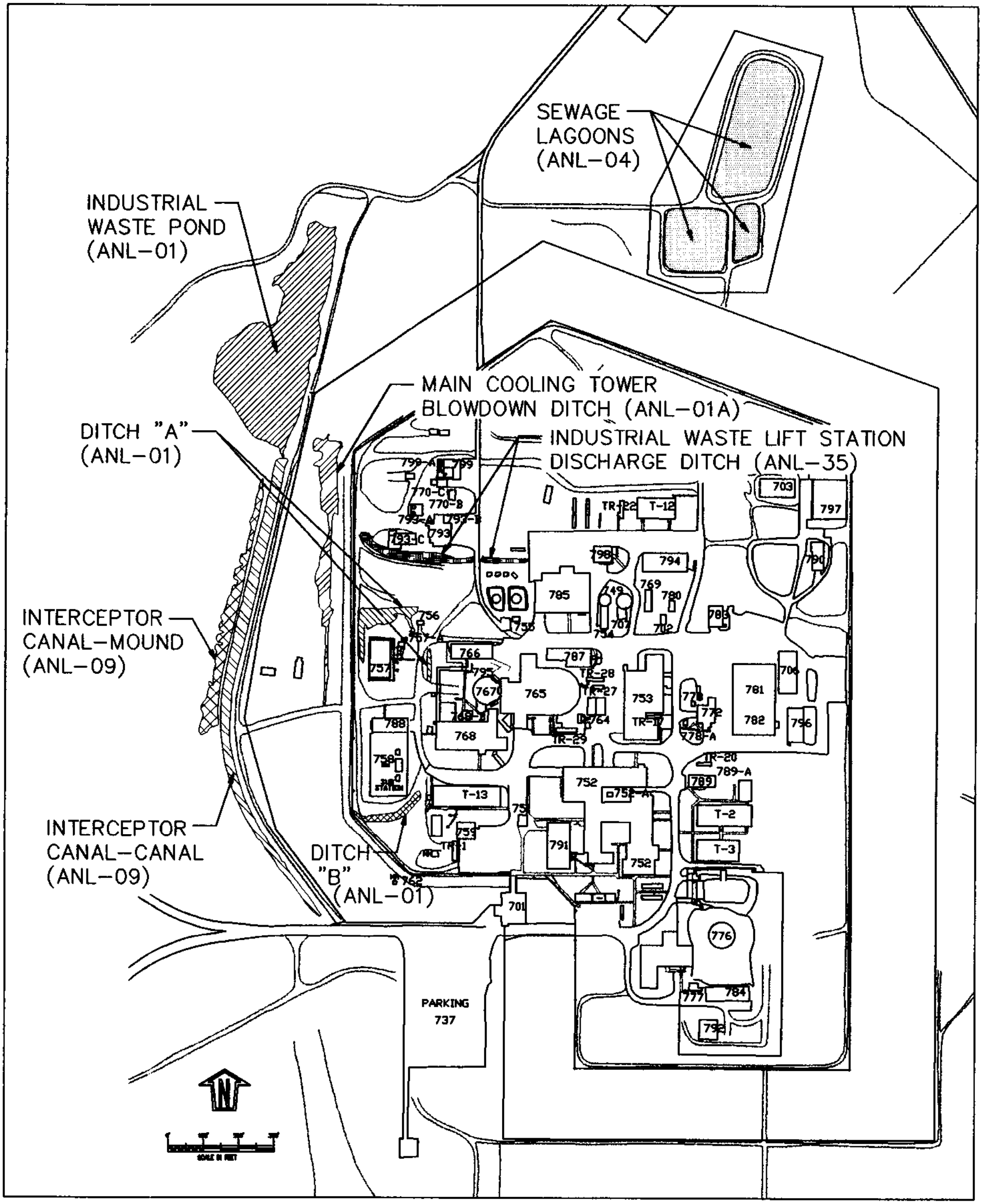

Figure 6-1. Eight Areas at ANL-W with Unacceptable Human Health or Ecological Risks.

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7 DESCRIPTION OF ALTERNATIVES

7.1 Remedial Action Objectives

Remedial action objectives (RAOs) for OU 9-04 sites with unacceptable risks were developed in accordance with the NCP and CERCLA RI/FS guidance. The RAOs were defined through discussions among the three agencies (IDHW, EPA, and DOE). The RAOs are based on the results of the human health and ecological risk assessment and are specific to the COCs and exposure pathways developed for OU 9-04. They are as follows:

- For protection of human health:
  - Prevent direct exposure to radionuclide contaminants of concern (COCs) that would result in a total excess cancer risk of greater than 1 in 10,000 to 1 in 1,000,000 (1E-04 to 1E-06) to current and future workers and future residents.
- For protection of the environment:

  Prevent exposure to COCs in soils which may have potential adverse effects to resident populations of flora and fauna, as determined by a HQ = 10 times the HQ calculated from INEEL background soil concentrations.

To meet these objectives, remediation goals (RGs) were established. These goals are quantitative cleanup levels based primarily on ARARs and risk-based doses. The RGs are used in remedial action planning and the assessment of effectiveness of remedial alternatives. Final RGs are based on the results of the baseline risk assessment and evaluation of expected exposures and risks for selected alternatives.

The 1 chance in 10,000 risk (1E-04) for human health and a hazard quotient of 10 times the INEEL background for ecological receptors were used to determine the RGs for the OU 9-04 sites of concern. For human health the basis for using the upper end of the NCP risk range of 1E-04 to 1E-06 was based on the remoteness of the INEEL site, conservativeness of the risk assessment, the absence of current residents, results based on the 100-year DOE control of INEEL lands, and current and future occupational workers are and will continue to be protected by standard operating procedures that are inplace and will continue to be updated while the ANL-W is operating. The RGs for the remediation of the cesium-137 for humans was determined by using a backward calculation of the concentration needed to produce a risk of 1E-04. Likewise, the RGs for the ecological receptors were also risk based and were determined by back calculating the concentrations equal to 10 times the HQ resulting from INEEL background soils. Table 7-1 shows the final RGs that have been established for the eight areas of concern at ANL-W.

Remedial actions will ensure that risk is mitigated to the point that exposure would not exceed these levels. On the basis of these RGs, areas and volumes of contaminated media that would require some form of remedial action were identified. These estimated areas, depths, and volumes for the eight areas to be remediated are presented in Table 7-2.

Table 7-1. Final Remediation Goals for the WAG 9 Sites.

Receptor	Site	Contaminant	95% UCL Concentration[1]	RG* Concentration[1]
Human Health	Interceptor Canal-Mound (ANL-09)	cesium-137	30.53	23.3
Human Health	Interceptor Canal-Canal (ANL-09)	cesium-137	18	23.3
Human Health	Industrial Waste Pond (ANL-01)	cesium-137	29.2	23.3
Ecological	Industrial Waste Pond (ANL-01)	chromium III	1,030	500
Ecological	Industrial Waste Pond (ANL-01)	mercury	2.62	0.74
Ecological	Industrial Waste Pond (ANL-01)	selenium	8.41	3.4
Ecological	Industrial Waste Pond (ANL-01)	zinc	5,012	2,200
Ecological	Ditch A (ANL-01)	mercury	3.94	0.74
Ecological	Ditch B (ANL-01)	chromium III	1,306	500
Ecological	Ditch B (ANL-01)	zinc	3,020	2,200
Ecological	Main Cooling Tower Blowdown Ditch (ANL-01A)	chromium III	709	500
Ecological	Main Cooling Tower Blowdown Ditch (ANL-01A)	mercury	8.83	0.74
Ecological	Sewage Lagoons (ANL-04)	mercury	3.2	0.74
Ecological	Industrial Lift Station Discharge Ditch (ANL-35)	silver	352	112

[1] - Concentrations in mg/kg or pCi/g
* - Backward calculated risk-based concentration at the 1E+04 level.

Table 7-2. Volume of Contaminated Soil in the Eight areas Retained for Cleanup.

OU 9-04 Release site	Site name	Width (ft)	Length (ft)	Depth (ft)	Volume (yd^3)
ANL-01	Industrial Waste Pond	200	250	0.5	926
ANL-01	Ditch A	5	400	0.5	37
ANL-01	Ditch B	5	1,400	1.3	337
ANL-01A	Main Cooling Tower Blowdown Ditch	6	700	2	311
ANL-04	Sewage Lagoons	300	700	1	7,778
ANL-09	Interceptor Canal-Mound	20	500	4	1,481
ANL-35	Industrial Waste Lift Station Discharge Ditch	4	500	1	74

7.2 Summary of Alternatives

In accordance with Section 121 of CERCLA, the FS identified alternatives that (a.) achieve the stated RAOs, (b.) provide overall protection of human health and the environment, (c.) meet ARARs, and (d.) are cost effective. These alternatives, used individually or in combination, can satisfy the RAOs through reduction of contaminant levels, volume or toxicity, or by isolation of contaminants from potential exposure and migration pathways. For the OU 9-04 sites, soil is the only medium of concern targeted for remediation. Five alternative categories were identified to meet the RAOs for contaminated soil at OU 9-04 sites:

1. No Action (with monitoring)
2. Limited Action
3. Containment with Institutional Controls
4. Excavation and Disposal
5. Phytoremediation

Estimated present work costs for the remedial alternatives for all sites are shown in Table 9-3 in Section 9. Post-closure costs were estimated for 100-years of monitoring for Alternative 3, where the contaminants were left at WAG 9. For Alternatives 4 and 5, where contaminants are removed or treated to meet the RAOs, the monitoring period extended to the end of the removal or until the RAOs are met through treatment. DOE controls will be implemented for Alternatives 4 and 5, after the RAOs are met.

7.2.1 Alternative 1: No Action (With Monitoring)

Formulation of a No Action alternative is required by the NCP [40 CFR 300.430 (e)(6)] and guidance for conducting feasibility studies under CERCLA. The No Action alternative serves as the baseline for evaluating other remedial action alternatives. This alternative can include environmental monitoring, but does not include actions to reduce potential exposure pathways, such as fencing or deed restrictions. Therefore, the No Action alternative developed for OU 9-04 sites involves only environmental monitoring (groundwater, air, and sediment) in accordance with DOE Orders and the ANL-W Environmental Monitoring Plan for at least 100 years after site closure. The monitoring would be necessary to validate that none of the contaminants were shown to migrate off-site or into the groundwater through modeling used in the OU 9-04 Comprehensive RI/FS.

While the No Action alternative does not involve any construction or operational activities that would result in disturbances to the surfaces of the OU 9-04 sites, IDAPA 16.01.01.650 (Rules for fugitive dust) could nonetheless apply to any sites that were a source of fugitive dust and is, therefore considered an ARAR that would not be met. Inorganics present in fugitive dust would not meet IDAPA 16.01.01.585-586 (Rules for the Control of Air Pollution in Idaho). IDAPA 16.01.11.200 (Rules for groundwater quality) would be met by ongoing groundwater monitoring. The No Action alternative would not meet DOE Orders because health risks to current workers and the potential future residents exceed allowable ranges. The estimated cost for implementing the No Action (with monitoring) alternative is relatively low when compared to the other alternatives.

7.2.2 Alternative 2: Limited Action

The limited action alternative involves only institutional controls to remain in effect for the next 100 years. This alternative essentially continues management practices currently in place at OU 9-04 and will continue for the next 100 years of DOE control. Actions under this alternative focus on routine maintenance and upkeep of the drainage ditches and Industrial Waste Pond, restricting access (posting warning signs and deed restrictions), and environmental monitoring including radiation surveys.

Current management practices and institutional controls are in place as a result of DOE responsibilities and authorities for maintaining security, control, and safety at DOE facilities, These responsibilities and authorities have their basis in the Atomic Energy Act of 1954. For DOE facilities, Federal Regulation 10 CFR 835 implements the Radiation Protection Guidance to Federal Agencies for Occupational Workers, recommended by the EPA and issued by the President on January 20, 1987. The requirements of this regulation include standards for control of occupational radiation exposure, control of access to radiological areas, personnel training, and record keeping.

In addition, the regulations specify limits for maintaining occupational radiation exposure as low as reasonably achievable (ALARA), and requires that DOE activities be conducted in compliance with a documented radiation protection program approved by DOE. At the INEEL, the requirements of 10 CFR 835 are primarily implemented through DOE Order 5400.5. Regulations for protection and security of DOE facilities are included in 10 CFR 860, which prohibits unauthorized entry. This regulation is implemented through DOE Order 5632.1C.

Specific controls (e.g., fences, signs) that will be used to ensure that access will be restricted, the types of activities that will be prohibited in certain areas (e.g., excavation), and anticipated duration of such controls will be placed in the "INEEL Comprehensive Facility and Land Use Plan" maintained by the DOE-ID Office of Program Execution. DOE shall also provide the Bureau of Land Management the detailed description of controls identified above. This information will be submitted to the EPA and IDHW once it has been placed in the INEEL Comprehensive Facility and Land Use Plan.

Monitoring and radiation survey programs would be established to ensure that the contaminants remain within the boundaries of the OU 9-04 sites, and would provide early detection of potential contaminant migration. These programs would be implemented annually for the first 5 years following site closure. The need for further environmental monitoring would be evaluated and determined by the Agencies during subsequent 5-year reviews.

Short-term effectiveness of this alternative is considered high, as this alternative is already implemented at the most of the sites. Radiation control area fences and signs are maintained. No specialized equipment, personnel, or services are required to continue to implement the Limited Action alternative. Implementation of this alternative would have no physical effect or habitat alteration on the environment beyond what has already occurred. The estimated costs for this alternative are shown in Table 9-3 of this ROD.

7.2.3 Alternative 3a and 3b: Containment Alternatives and Institutional Controls

The two centralized containment alternatives consist of the consolidation and isolation of contaminated soil from potential receptors for the period of time that unacceptable cumulative exposure risks will be present. This consolidation would place the contaminated soils from the OU 9-04 sites into an engineered landfill at WAG 9. The landfill would have a thick soil and/or rock cover placed over it. The containment alternatives would include: long-term environmental monitoring, cover integrity monitoring and maintenance, access restrictions, and surface water diversion. Institutional controls are assumed to remain in effect for at least 100 years. These two centralized containment alternatives were considered for all eight areas at ANL-W.

Alternative 3a consists of consolidation of contaminated soils and capping with engineered cover originally developed by the Uranium Mill Tailings Remedial Action (UMTRA) program for stabilization of abandoned uranium mill tailings. This design, based on the recent biointrusion research studies at the INEEL, was recently constructed at the INEEL Stationary Low-Power Reactor-I burial ground site. Advantages of this engineered cover are:

- Requires minimal maintenance
- Inhibits inadvertent human intrusion
- Minimizes plant and animal intrusion
- Inhibits contaminant migration

The cover design consists of four layers of natural geological materials including native soil, gravel, basalt cobbles, and rip-rap. Implementing Alternative (3a), for sites at ANL-W would entail consolidation of soils from both the radiological and ecological sites into one centralized location at WAG 9 prior to capping. The volume of soils in most of the ANL-W sites is relatively small and the costs associated with building multiple engineered covers at each release site is not justifiable. The most logical centralized location for the engineered cover would be near the Interceptor Canal and the Industrial Waste Pond which have the largest volume of contaminated soil. The engineered cover (3a) would prevent both human and ecological receptors from contacting the soils. Additionally the engineered cover (3a) would be sloped accordingly to prevent ponding of surface waters which should have the potential to migrate through the soils and "leach out" the radiological and inorganic contaminants. Site-specific considerations (such as annual precipitation, frost depth, and anticipated soil erosion rates) would be used to design the optimum configuration for this alternative during the remedial design phase.

Alternative 3b consists of consolidation of contaminated soils in an engineered landfill with a native soil cover. The native soil cover would consist of 10 ft of clean INEEL soil, with a surface covering of vegetation, rock armor or other material. Implementing this alternative at OU 9-04 would require a centralized location near the release sites in which to build the containment, moving the contaminated soil to the centralized location, and then adding clean soil layers above grade to bring the total thickness to 10 ft. The native soil cover is applicable to both the radiologically and inorganically contaminated sites. The long-term effectiveness of this type of cap to prevent exposure of inorganics past the 100-year institutional control period is not known. The native soils cap would be effective for the radiological contamination since the cesium-137 risk would be at the upper limit of the NCP risk range within 130 years.

Each capping technology is designed to prevent direct radiation exposures to resist erosion due to wind and surface water runoff, and to resist biointrusion that may penetrate into the contamination zone, or facilitate erosion. The primary differences between the two capping technologies are the length of time these functions can be maintained and the effectiveness of the biointrusion and erosion control components of the designs. The design life of the capping technologies specified for the containment alternatives will depend on the construction materials specified, number and thickness of layers required, and sequence of those layers. The long-term effectiveness and permanence required by the Interceptor Canal-Mound (ANL-09) and the Industrial Waste Pond (ANL-01) is driven by the radioactive decay of the cesium-137 contaminant in their soils and sediments. The cesium-137 contaminant will decay to acceptable risk levels in 130 years. The multilayered engineered barrier design (alternative 3a) is likely to provide a higher level of protection against biointrusion. A 10-foot thick soil cover would eliminate intrusion into contaminated soil by most of the burrowing INEEL species, but not all plants and invertebrates. Root intrusion into contaminated soils could result in mobilization of radionuclides through the plant exposing environmental receptors. Costs associated with the cover alternatives at each site are detailed in Sections 8 and 9 of this ROD.

7.2.4 Alternatives 4a and 4b: Excavation and Disposal

These alternatives involve complete removal of contaminated materials that pose an unacceptable risk to human health and/or ecological receptors. Two alternatives were evaluated during the WAG 9 RI/FS. Alternative 4a consists of excavation and disposal at two on-INEEL location whereas in Alternative 4b the soils would be disposed at an off-INEEL private facility. Both Alternatives 4a and 4b would include collection of verification samples after removal to ensure that the final remediation goals were met.

Implementation of Alternative 4a would require excavating all soils and debris from the radiological and inorganic contaminated sites that are above the RGs, and transporting the soil to either the proposed INEEL Soil Repository, or the Radioactive Waste Management Complex (RWMC). An INEEL Soils Repository, is included as part of the WAG 3 Proposed Plan that will be presented for public comment in the fall of 1998. The other option for on-INEEL disposal is to use the currently operating RWMC facility. Each of these on-INEEL facilities are expected to have or will have specific acceptance criteria that the WAG 9 soils currently meet. The final selection between the on-INEEL disposal areas would be completed during the WAG 9 RD/RA workplan development that is scheduled to start in the summer of 1998. The excavation and transport of the radiologically contaminated soils would require additional monitoring to verify that workers do not receive excessive radiation exposure. Verification sampling would be used to ensure that all contamination exceeding RGs was removed.

Implementation of Alternative 4b would require excavation of all soils and debris from the radiological and inorganically contaminated soil sites that are above the RGs, and transporting the soil to a rail transfer station at the INEEL Central Facilities Area (CFA) for shipment to a private off-INEEL disposal facility. The operating permit for the private off-INEEL disposal facility will specify the radionuclide activity levels that can be accepted. The WAG 9 soils have concentrations that are currently acceptable by most off-INEEL facilities that are permitted to accept radiologically contaminated material. The excavation and transport of the radiologically contaminated soils would require additional monitoring to ensure that no excess exposures are encountered. Verification sampling would be performed to ensure all contamination above the RGs has been removed.

These alternatives will provide long-term effectiveness because the contamination would be removed from the site. Long-term monitoring would no longer be required, assuming removal of contaminated soils achieve acceptable levels. DOE will continue with short-term monitoring of the soil, air, vegetation, and groundwater for 20 years in accordnace with DOE Orders and the ANL-W Enviornmental Monitoring Plan until 2018. These samples will be collected only to ensure continued compliance of current discharges and/or migration from past releases. After implementation of either Alternative 4a or 4b, the contaminated soil concentrations will be below the remediation goals. The remediation will ensure that the RGs would meet the established remedial action objectives. Costs of the excavation and disposal for both on-INEEL Alternatives 4a (proposed INEEL Soils Repository or using the currently existing RWMC facility) as well as costs of Alternative 4b (private off-INEEL facility) are shown in Sections 8 and 9 of this ROD.

7.2.5 Alternative 5: Phytoremediation

Alternative 5, would be implemented for both the radiological and inorganic contaminated sites at ANL-W. This alternative would consist of in situ remediation of the contaminated sites using cultivated and harvested plants to extract contaminants from soil. This alternative would avoid high excavation, transport, and disposal costs. One site, the ANL-09-Mound, has radiological contamination to a maximum depth of four feet and may require grading of the contaminanted soils to facilitate the use of farming equipment.

The phytoremediation alternative appears to have applicability for remediation of contaminants for soils at ANL-W based on the performance of phytoremediation at other DOE sites. To determine if phytoremediation has the potential to meet the RAOs for ANL-W soils, bench-scale greenhouse test are currently being performed. The results of the bench-scale greenhouse tests will determine which plants have the greatest potential to remove the ANL-W radionuclides and inorganics. The bench-scale testing is currently being conducted, with presentation of results scheduled for late summer of 1998. A phytoremediation Work Plan has been written to describe the major activities associated with the bench-scale testing of phytoremediation on ANL-W soils.

If, after the bench-scale greenhouse tests is completed, the results are not favorable (based on problems with contaminant extraction rates, costs, or increased contaminant leaching due to irrigation), phytoremediation will be eliminated as a possible alternative. If the bench-scale testing shows favorable results, ANL-W will conduct a full-scale two-year demonstration field test in 1999 and 2000 on the ANL-W sites of concern. Engineering controls would be utilized to control possible spread of contamination. Propagation of nonnative plants will be controlled by harvesting prior to the plants going to seed. The plant matter will be dried, baled, and stored in a controlled area prior to shipment to an incinerator for volume reduction in accordance with off-site requirements. Air pollution controls used to control air emissions would be required and the resulting ash would be properly disposed of in an approved disposal facility. Depending on the plants that are selected, two or more "crops" are possible each field season. After completion of the two-year demonstration field test (1999 and 2000), ANL-W will collect data to determine if the process is working as predicted in the actual field situation. This data will be used to determine the remaining number of field seasons that would be required to meet the RGs as well as provide a means of projecting future costs. This field data would be required to determine the feasibility of the technology for the treatment of the radiological and inorganic contaminants at WAG 9. In the fall of 2000, after analysis of the soil samples, the agencies will review the data and make the determination on continued use of phytoremediation at WAG 9. If phytoremediation is working and the process is continued, verification sampling would be used after the final field season to ensure that the RGs have been met.

This alternative provides long-term effectiveness and permanence because the soils would actually be treated insitu to remove the contaminant. Long-term monitoring would no longer be required, assuming removal of contaminated soils achieve acceptable levels. DOE will continue with short-term soil, air, vegetation, and groundwater sampling for 20 years in accordance with DOE orders and the ANL-W Environmental Monitoring Plan until the year 2018. These samples will be collected only to ensure continued compliance of current discharges and/or migration from past releases. CERCLA five-year reviews would be required for the next 100 years to ensure that the RGs would meet the established RAOs. DOE anticipates that the five-year reviews will consist of a memorandum summarizing a checklist-driven inspection of the signs, fences, and other physical features that assure DOE controls are still in place. Costs of insitu phytoremediation are shown in Sections 8 and 9, and are relatively low as compared to other alternatives that do not treat the contaminated soils.

7.3 Summary of Comparative Analysis of Alternatives

The five alternatives discussed in Section 7.2 were evaluated using the nine evaluation criteria as specified by CERCLA. These criteria are:

1. *Overall protection of human health and the environment*- addresses whether a remedy provides adequate protection of human health and the environment, and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. *Compliance with ARARs*- addresses whether a remedy will meet all of the ARARs under federal and state environmental laws and/or justifies a waiver.

3. *Long-term effectiveness and permanence*- refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

4. Reduction of toxicity, mobility, or volume through treatment- addresses the degree to which a remedy employs recycling or treatment that reduces the toxicity, mobility, or volume of the COCs including how treatment is used to address the principal risks posed

by the site.

5. *Short-term effectiveness*- addresses any adverse impacts on human health and the environment that may be posed during the construction and implementation period, and the period of time needed to achieve cleanup goals.

6. *Implementability*- addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. *Cost*- includes estimated capital and operation costs, expressed as net present-worth costs.

8. *State acceptance*- reflects aspects of the preferred alternative and other alternatives that the state favors or objects to, and any specific comments regarding state ARARs or the proposed use of waivers.

9. *Community acceptance*- summarizes the public's general response to the alternatives described in the Proposed Plan and in the RI/FS. The evaluation of this criterion is based on public comments received.

Table 7-3 presents the results of the comparative analysis of the five alternatives using a ranking based on an alternative's ability to meet the nine evaluation criteria. Table 7-4 provides a ranking of alternatives for each on the basis of the comparative analysis. The following sections describe how each alternative either does or does not meet the criteria.

Each of the five alternatives subjected to the detailed analysis was evaluated against the nine evaluation criteria identified under CERCLA. The criteria are subdivided into three categories: (1) threshold criteria that mandate overall protection of human health and the environment and compliance with ARARs; (2) primary balancing criteria that include long- and short-term effectiveness, implementability, reduction in toxicity, mobility, or volume through treatment, and cost: and (3) modifying criteria that measure the acceptability of alternatives to state agencies and the community. The following sections summarize the evaluation of the five alternatives against the nine evaluation criteria.

7.3.1 Threshold Criteria

The remedial alternatives were evaluated in relation to the two threshold criteria: overall protection of human health and the environment and compliance with ARARs. The selected remedial action must meet the threshold criteria. Although the No Action alternative does not meet the threshold criteria, this alternative was used in the detailed analysis as a baseline against which the other alternatives were compared, as directed by EPA guidance. Alternatives 2 and 3b, limited action and containment with native soil cover, respectively, do not meet the threshold criteria for protection of the environment due to the potential for plant root intrusion and were screened from further evaluation in the FS.

Table 7-3. Comparative Analysis of Remedial Alternatives Using the Evaluation Criteria.

Criteria	Alternative 1 No action	Alternative 3a Engineered cover	Alternative 4a: Conventional excavation and off-site disposal at INEEL Soil Repository or RWMC	Alternative 4b: Conventional excavation and off-site disposal at private facility	Alternative 5: Phytoremediation
Overall protection of human health and the environment					
Human health protection	No reduction in risk.	Engineered cap would prevent direct exposure to contaminated soil and debris for over 130 years. Minimal exposure risks during cap construction.	Eliminates potential exposure from contaminated soil at site. Protectiveness is based on completely removing contamination from site. Short-term risk is moderate due to direct exposure during excavation.	Eliminates potential exposure from contaminated soil at site. Protectiveness is based on completely removing contamination from site. Short-term risk is moderate due to direct exposure during excavation.	Treatment reduces the potential exposure from contaminated soil at site to acceptable levels. Long term protectiveness is based on reduction of the concentrations. Short-term risk is low.
Environmental protection	Allows possible migration of contaminated surface soil by wind and surface water erosion.	Provides effective protection for over 130 years. Minimal environmental impacts during construction.	Eliminates contamination from site.	Eliminates contamination from site.	The treatment reduces the contaminant concentrations below the RGs.
Compliance with ARARs					
Action-specific					
Idaho Fugitive Dust Emissions-IDAPA 16.01.01.650 et seq.	Would not meet ARAR because no controls would be implemented	Will meet ARAR by eliminating potential for windblown soil contamination	Will meet ARAR by eliminating potential for windblown soil contamination	Will meet ARAR by eliminating potential for windblown soil contamination	Will meet ARAR by eliminating potential for windblown soil contamination both during and after treatment.
Idaho Hazardous Waste Management Act-IDAPA 16.01.05.005 et seq.	NA	NA	Soil samples would be collected and analyzed so wastes can be regulated as necessary	Soil samples would be collected and analyzed so wastes can be regulated as necessary	Plant samples would be collected and analyzed so wastes can be regulated as necessary
Idaho Hazardous Waste Management Act-IDAPA 16.01.05.006 et seq.	NA	NA	NA	NA	Plant samples will be tested by using approved methods to determine if the plant matter is hazardous waste.

Table 7-3. (continued).

Criteria	Alternative 1 No action	Alternative 3a Engineered cover	Alternative 4a: Conventional excavation and off-site disposal at INEEL Soil Repository or RWMC	Alternative 4b: Conventional excavation and off-site disposal at private facility	Alternative 5: Phytoremediation
General Requirements for shippers 49 CFR 173	NA	NA	Placards would be applied to the trucks during transport on-INEEL facility	Placards would be applied to the trucks and rail cars during transit to the off-INEEL facility.	Trucks used to transport the plant matterial will have the have the appropriate placards.
Nationcal Contingency Plan -Procedures for planning and implementing off-site response actions (40CFR 300.440)	NA	NA	NA	NA	If determined to be a hazardous waste, the ash from incinerated plant matter will be shipped off-site to a RCRA Subtitle C landfill which is operated in compliance with RCRA.
Chemical-specific					
NESHAPS-40 CFR 61.92	NA	Would meet ARAR by controlling the source term for all exposure pathways.	Would meet ARAR by eliminating the source term for all exposure pathways.	Would meet ARAR by eliminating the source term for all exposure pathways.	Would meet ARAR by treating the soils so the contaminants are below the RGs for all exposure pathways.
Rules for the Control of Air Pollution in Idaho-IDAPA 16.01.01.585 and .586	Would not meet ARAR if toxic metals or organics were present in fugitive dust, because no controls would be implemented.	Would meet ARAR through use of engineering controls.	Would meet ARAR by removing contamination from site.	Would meet ARAR by removing contamination from site.	Would meet ARAR by treatment to reduce the contamination to levels below the RGs.
Location-specific					
National Historic Preservation Act-16 USC 470	NA	These sites are in areas that are 50 years old in previously disturbed areas. If cultual artifacts are encountered, DOE will stop work and conduct a detailed survey of the area.	These sites are in areas that are 50 years old in previously disturbed areas. If cultual artifacts are encountered, DOE will stop work and conduct a detailed survey of the area.	These sites are in areas that are 50 years old in previously disturbed areas. If cultual artifacts are encountered, DOE will stop work and conduct a detailed survey of the area.	These sites are in areas that are 50 years old in previously disturbed areas. If cultual artifacts are encountered, DOE will stop work and conduct a detailed survey of the area.

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Table 7-3. (continued).

Criteria	Alternative 1 No action	Alternative 3a Engineered cover	Alternative 4a: Conventional excavation and off-site disposal at INEEL Soil Repository or RWMC	Alternative 4b: Conventional excavation and off-site disposal at private facility	Alternative 5: Phytoremediation
To Be Considered					
Environmental Protection, Safety, and Health Protection Standards-DOE Order 440.1	Would not meet TBC because no controls would be implemented.	Would meet TBC through use of engineering and institutional controls and best management practices.	Would meet TBC through use of engineering controls and best management practices..	Would meet TBC through use of engineering controls and best management practices..	Would meet TBC through use of engineering controls and best management practices.
Radioactive Waste Management-DOE Order 5820.2A and new order 435.1 in FY 2000	Would not meet TBC because no controls would be implemented.	Would meet TBC through use of engineering and institutional controls and best management practices.	Would meet TBC through use of engineering controls and best management practices.	Would meet TBC through use of engineering controls and best management practices.	Would meet TBC through use of engineering controls and best management practices. Final disposal of plant matter after incineration.
Radiation Protection of the Public and Environment-DOE Order 231.1	Would not meet TBC because no controls would be implemented.	Would meet TBC through use of engineering and institutional controls and best management practices.	Would meet TBC through use of engineering controls and best management practices.	Would meet TBC through use of engineering controls and best management practices.	Would meet TBC through use of engineering controls and best management practices. Final incineration of biomass would be conducted in an approved facility.
Long-term effectiveness and permanence					
Magnitude of residual risk	No change from existing risk.	Source-to-receptor pathways eliminated while cap remains in place. Inherent hazards of inorganics would remain. Cs-137 within 1E-04 acceptable range after 130 years.	No reduction in contaminant concentrations. All contaminated soils would be removed from site and transported for disposal at another facility.	No reduction in contaminant concentrations. All contaminated soils would be removed from site and transported for disposal at another facility.	In-situ treatment of the soils would result in contaminant levels that are below the RGs.
Adequacy and reliability of controls	No control and, therefore, no reliability.	Limited access to contaminated soil and environmental monitoring effective only during institutional period of control (at least 100 years). Barrier control over contaminated soil for at least 130 years.	Disposal facility is assumed to provide adequate and reliable control over disposed soil and debris.	Disposal facility is assumed to provide adequate and reliable control over disposed soil and debris.	Phytoremediation treatment has been successfully used in mining applications. Contingency alternative could be selected if phytoremediation is not working at ANL-W.

Table 7-3. (continued).

Criteria	Alternative 1 No action	Alternative 3a Engineered cover	Alternative 4a: Conventional excavation and off-site disposal at INEEL Soil Repository or RWMC	Alternative 4b: Conventional excavation and off-site disposal at private facility	Alternative 5: Phytoremediation
Reduction of toxicity, mobility, or volume through treatment					
Treatment process used	NA	NA	NA	NA	Phytoremediation.
Amount destroyed or treated	NA	NA	NA	NA	All radioactively and inorganically contaminated soils above the RGs.
Reduction of toxicity, mobility, or volume	None	None	None	None	No reduction in toxicity, the most mobile contaminants will be removed, and no increase in volume of contaminated soil. The volume of biomass would be incinerated to reduce volume to be disposed.
Irreversible treatment	NA	NA	NA	NA	Yes
Type and quantity of residuals remaining after treatment	NA	NA	NA	NA	The soils remaining after treatment will contain contaminants below the RGs. The soil can be reused for any application such as farming, or community development.
Statutory preference for treatment	NA	NA	NA	NA	Treatment method is relatively new and more plant species are being tested for their affinity to bioaccumulate contaminants.
Short-term effectiveness					
Community protection	No increase in potential risks to the public.	No increase in potential risks to the public.	Slight increase in potential risks to the public during off-site transportation.	Slight increase in potential risks to the public during off-site transportation.	No increase in potential risks to the public.

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Table 7-3. (continued).

Criteria	Alternative 1 No action	Alternative 3a Engineered cover	Alternative 4a: Conventional excavation and off-site disposal at INEEL Soil Repository or RWMC	Alternative 4b: Conventional excavation and off-site disposal at private facility	Alternative 5: Phytoremediation
Worker protection	No increase or decrease in potential risks to the worker.	Worker risk during barrier installation is minor due to shielding afforded by existing clean soil and engineering controls.	Worker risk is minimal after the soil is removed and meets the established RAOs.	Worker risk is minimal after the soil is removed and meets the established RAOs.	Worker risk from exposure to contaminated soil during farming activities will require administrative and engineering controls.
Environmental impacts	No change from existing conditions.	Limited to disturbances from vehicle and material transport activities associated with barrier construction. Limited potential for airborne contamination in the form of fugitive dust, due to use of engineering controls.	Limited to disturbances from vehicle and material transport activities associated with excavation. Limited potential for airborne contamination in the form of fugitive dust, due to use of engineering controls.	Limited to disturbances from vehicle and material transport activities associated with excavation. Limited potential for airborne contamination in the form of fugitive dust, due to use of engineering controls.	Limited increase in animal usage of the sites outside the ANL-W facility during the phytoremediation. Very small potential for airborne contamination in the form of fugitive dust, due to use of engineering controls and irrigation.
Time until action is complete	NA	Approximately 12 to 15 months.	Approximately 18 to 24 months.	Approximately 18 to 24 months.	Estimated to be 5 years based on the use of multiple plantings per field season.
<u>Implementability</u>					
Ability to construct and operate	No construction or operation.	Involves available construction technology.	Somewhat difficult, due to redundant and/or conflicting safety requirements for ANL-W and LMITCO.	Somewhat difficult, due to redundant and/or conflicting safety requirements rom both ANL-W and LMITCO. Potential scheduling problems because of rail shipment to off-site private facility.	Small farming equipment is readily available. Site application to select plant species, soil amenities, irrigation schedules, and disposal of biomass will be determined per field season.

Table 7-3. (continued).

Criteria	Alternative 1 No action	Alternative 3a Engineered cover	Alternative 4a: Conventional excavation and off-site disposal at INEEL Soil Repository or RWMC	Alternative 4b: Conventional excavation and off-site disposal at private facility	Alternative 5: Phytoremediation
Ease of implementing additional action if necessary	May require repeat of feasibility study/ record of decision process.	Additional remedial actions would be difficult, as the barrier is intended to prevent access to contamination. Barrier would require removal.	Shipment of the soil to an on-site disposal facility would require interaction between ANL-W and LMITCO that could cause delays in the schedule.	In addition to co-ordination between ANL-W and LMITCo, the off-site disposal facility would also have to be involved in the discussions and scheduling.	Use of this treatment technology would not inhibit the use of a different alternative later.
Ability to monitor effectiveness	Monitoring of conditions is readily implemented.	Barrier performance can be monitored through radiation surveys, and can be visually assessed on the basis of physical integrity.	The effectiveness in removing all contaminated materials associated with site is easily monitored.	The effectiveness in removing all contaminated materials associated with site is easily monitored.	The effectiveness in removing contaminants to levels below the RGs can be determined through sampling. Once the soil is treated future monitoring would not be required.
Ability to obtain approvals and coordinate with regulatory agencies	No approvals required.	No difficulties identified.	Potentially difficult, due to additional requirements for environmental assessments, safety analyses, and ARARs compliance.	Potentially difficult, due to additional requirements for environmental assessments, safety analyses, and ARARs compliance.	No difficulties identified.
Availability of services and capacity	None required.	Barrier design and services reside within the DOE and are considered readily available to the INEEL.	Services available either onsite or offsite through subcontractor.	Services available either onsite or offsite through subcontractor.	Services available either onsite or offsite through subcontractor.
Availability of equipment, specialists, and materials	None required	Equipment and materials are readily available at the INEEL or within surrounding communities.	Equipment and materials are either available onsite, through subcontractors or will be purchased. Trained specialists are available within the communities surrounding the INEEL.	Equipment and materials are either available onsite, through subcontractors or will be purchased. Trained specialists are available within the communities surrounding the INEEL.	Equipment and materials are either available onsite or through subcontractors.
Availability of technology	None required	Readily available at the INEEL.	Readily available at the INEEL.	Readily available at the INEEL.	Readily available at ANL-East with experienced personnel.
Cost (present worth)					
	See Table 9-2	See Table 9-2	See Table 9-2	See Table 9-2	See Table 9-2

NA = Not Applicable

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Table 7-4. Comparative Analysis of Remedial Alternatives.

Evaluation Criteria	Alternative				
	3a	4a[1]	4a[2]	4b	5
Overall Protection of Human Health and the Environment	Meets	Meets	Meets	Meets	Meets
Compliance with Applicable and Relevant and Appropriate Requirements	◗	◗	◗	◗	●
Long-term Effectiveness and Permanence	○	◗	◗	◗	●
Short Term Effectiveness	○	◗	◗	◗	◗
Reduction of Toxicity, Mobility, or Volume Through Treatment	○	○	○	○	●
Implementability	●	●	●	●	◗
Cost (in millions)	7.6	5.9	5.9	13.1	2.8

● = Best ◗ = Good ○ = Worst

[1] - Using RWMC.
[2] - Using the Proposed INEEL Soils Repository at WAG 3.

7.3.1.1 Overall Protection of Human Health and the Environment

The primary measure of this criterion is the ability of an alternative to achieve RAOs for the sites. Since this is a threshold criterion, each alternative must be able to meet the RAOs in order for the alternative to be retained. Alternatives 4a, 4b, and 5 meets the criteria and would provide the best long-term protection of human health and the environment because the soils would be removed from WAG 9 (Alternatives 4a and 4b) or the concentrations would be reduced to acceptable levels (Alternative 5). Alternatives 4a and 4b (conventional excavation and landfill disposal) would accomplish this by removing the contaminated soil from the ANL-W site. Alternative 3a (engineered landfill at WAG 9) meets the criteria because it would not prevent unacceptable exposure to cesium-137 after the 100-year DOE control period. Alternative 1 (no action) would not prevent exposures resulting in risks greater than 1E-04, and is therefore eliminated from further consideration.

7.3.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Compliance with ARARs is also a threshold criterion. Each alternative must be able comply with all ARARs in order for the alternative to be retained. For this criterion Alternative 5 is ranked the highest because the planting, harvesting and irrigating of the contaminated soils would result in no emissions of fugitive dust. Alternatives 3a, 4a, and 4b are ranked equally, since all are considered equally capable of achieving compliance through use of engineering controls to meet the State of Idaho regulations for controlling emissions of fugitive dust and toxic substances. Alternatives 3a, 4a, and 4b are also ranked equally in compliance with other ARARs.

7.3.2 Balancing Criteria

Once an alternative satisfies the threshold criteria, five balancing criteria are used to evaluate other aspects of the remedial alternatives and weigh major tradeoffs among alternatives. The balancing criteria are used in refining the selection of the candidate alternatives for the site. The balancing criteria are: (1) long-term effectiveness and permanence; (2) reduction in toxicity, mobility, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost.

7.3.2.1 Long-term Effectiveness and Permanence

Alternative 5 would provide the highest degree of long-term effectiveness and permanence, because the contamination would have been reduced to acceptable levels for this criterion. Alternative 4a and 4b provide the next highest degree of long-term effectiveness and permanence, because contaminated soil exceeding cleanup goals would no longer exist at the sites. Alternative 3a would be effective as long as the cap prevents human and biotic intrusion and controls erosion and leaching of contaminants.

7.3.2.2 Reduction in Toxicity, Mobility, or Volume Through Treatment

Alternative 5 is the only treatment alternative that provides reduction in toxicity mobility or volume through treatment. In addition to removing the contaminants from the soil, Alternative 5 also reduces the volume of contaminants to be disposed. For phytoremediation, a large reduction in volume is anticipated by incineration of the plant matter, incineration, and solidification of the ash as compared to excavation and disposal of the contaminated soil. The other alternatives were ranked the lowest since they do not reduce the toxicity, mobility, or volume of the contaminated soils through treatment. However, Alternative 3a, 4a, and 4b do reduce the toxicity and mobility of the contaminants through containment.

7.3.2.3 Short-term Effectiveness

These WAG 9 sites are not located near inhabited areas and no public roads are in the vicinity. Thus, no significant impacts to surrounding communities would be anticipated from exposure to contaminants during remediation in the WAG-9 sites. However, there is a potential short-term impact to workers who will be conducting the remedial action. Alternatives 4a, 4b, and 5 are equally ranked and are higher than Alternative 3a, because the wastes would remain on site or would only have to be moved once. Alternative 3a is ranked the lowest because the soils would have to be handled twice, once for the removal from the ditches and once when the soils are consolidated into the cap.

7.3.2.4 Implementability

Each of the alternatives retained for detailed analysis is technically implementable. The relative ranking of the alternatives with respect to implementability is shown in Table 7-4. Alternatives 3a, 4a, and 4b are equally ranked because they will require the procurement of a contractor to perform the excavation, construction, transport of equipment, permits, and coordination with other on-site and off-site contractors. These permits would consist of safe work permits, digging permits, radiation safe work permits, and transportation placards. Alternative 5 is ranked the lowest because of the unknowns associated with it meeting the RAOs within a cost effective time frame. The potential success of Alternative 5 will be determined through bench-scale and field testing. If Alternative 5 is utilized, ANL-W personnel can plant and harvest the phytoremediation plants and farming equipment is available locally.

7.3.2.5 Cost

Separate line item costs are developed for the primary components of each remedial action alternative, such as monitoring; capping; excavation; disposal; and reporting requirements such as remedial design/remedial action scope of work, remedial design/remedial action work plans, safety documentation, and progress reports. The estimated present worth cost of each alternative is shown in Table 9-3 and the relative ranking for this criterion is shown in Table 7-4.

7.3.3 Modifying Criteria

The modifying criteria, state and community acceptance, are used in the final evaluation of remedial alternatives. For both of these criteria, the factors include the elements of the alternatives that have strong opposition.

7.3.3.1 State Acceptance

The IDHW has been involved in the development and review of the RI/FS report, the Proposed Plan, and this ROD. All comments received from IDHW on these documents have been resolved and incorporated into these documents accordingly. In addition, IDHW has participated in public meetings where public comments and concerns have been received and responses offered.

The IDHW concurs with the selected remedial alternative of phytoremediation for the eight areas that have been identified for remedial action, as well as the 33 No Action sites in this ROD. The IDHW is signatory to the ROD with DOE and EPA.

7.3.3.2 Community Acceptance

Community participation in the remedy selection process includes participation in the public meetings held in January 1998 and review of the Proposed Plan during the public comment period of January 12 through March 12, 1998. Community acceptance is summarized in the Responsiveness Summary presented as Appendix A of this document. The Responsiveness Summary includes comments received either verbally or in writing from the public, and the agencies' responses to these comments.

As shown in the Responsiveness Summary, most of the public agreed with the selection of Alternative 5, phytoremediation to clean up the eight areas at ANL-W. The commentors also expressed concern over the possible selection of non-native plants, possible increased exposure to ecological receptors that may browse on the plants, and incineration and ash disposal issues. The agencies have addressed these comments and, where applicable, have incorporated these comments into this ROD. Other comments will be addressed during implementation and interpretation of the phytoremediation bench-scale greenhouse testing. The agencies appreciate the public's participation in this process and acknowledge the value of the public comment.

8 SELECTED REMEDY

The results of investigations and risk assessments at WAG 9, OU 9-04, at INEEL indicate that eight areas pose unacceptable risks to human health and/or the enviornment. Two areas have human heath carcinogenic risks greater than 1 in 10,000 (1E-04), five areas have unacceptable HQs greater than 10 times the HQ for INEEL background, and one area has both human and ecological risks. The investigation also showed that 33 FFA/CO sites do not exceed a 1E-04 carcinogenic risk or have HQ less than the 10 times the HQ for INEEL background, and therefore require no action. It is important to note that there are no unacceptable cumulative effects from the WAG 9 sites, and the remedial actions being recommended address individual risks as well as prevent cumulative risks to a future residential receptor at WAG 9. Based on consideration of the requirements of CERCLA, the detailed analysis of alternatives, and public comments, DOE, EPA, and IDHW have a selected and a contingent alternative for remediation of the sites contained in this ROD. The justification for the selection of the remedial alternatives is discussed in the following sections.

8.1 Ranking of Alternatives

Table 7-4 provides a summary of how the alternatives rank relative to one another. This comparative analysis provides a measure of the relative performance of alternatives against each evaluation criterion. The purpose of this comparison is to identify the relative advantages and disadvantages associated with each alternative.

Although the contaminated soil types (radiologically- and inorganically-contaminated soil) were evaluated separately against the evaluation criteria, both soil types produced similar rankings of the remedial alternatives. The overall ranking order of the alternatives is 5, 4a, 3a, and 4b. Thus, the information presented in the following paragraph presents the results of the ranking of soil types along with the justification for the selected alternative.

Each of the retained alternatives with the exception of the no action alternative (Alternative 1), would meet the remedial action objectives associated with the protection of human health and the environment. Alternative 1, No Action, does not meet the threshold criteria of overall protection of human health and the environment, but it serves as a baseline to determine the benefits of the other alternatives. Alternative 2, Limited Action and Alternative 3b, Native Soil Cap were screened prior to the detailed analysis of the alternatives because they do not meet the threshold criteria of overall protection of human health and the environment. However, certain limited action items such as access restrictions, land use restrictions, and monitoring are employed in Alternatives 3a, 4a, and 5. Alternatives 3a, 4a, and 4b meet all the remedial action objectives and provide overall protection of human health and the environment. But, these alternatives do not use treatment to reduce the toxicity, mobility, or volume of the contaminants. They do however eliminate the potential exposure of human and ecological receptors to the contaminants. Although Alternatives 3a, 4a, and 4b use similar containment technology to reduce the exposure of the contaminants to humans and the environment, Alternative 4a was ranked higher than Alternatives 3a and 4b because of the lower present value costs. Alternative 5 is the only alternative that reduces the toxicity, mobility, and volume of the contaminated media through treatment. In addition, it is anticipated that the costs of using phytoremediation are less than the costs of Alternatives 3a, 4a, and 4b. Alternative 5 can be used for both radiologically and inorganically contaminated soils and provides a barrier against windblown contamination. Alternative 5 best meet the first seven evaluation criteria and is therefore the preferred alternative. Alternative 5, reduces the mass of contaminated material that must be disposed of to less then one percent of the mass of the contaminated soil. After the anticipated five field seasons for phytoremediation, the concentrations of contaminants in the soils should meet the established RAOs and the soils will remain under land use and access restrictions until they can be released for unlimited used. DOE anticipates that this wil be in approximately 100 years from now (2098).

8.2 Selected Remedy

The selected remedial remedy for the eight WAG 9 areas with unacceptable risks to human health and/or the environment is Alternative 5, phytoremediation. This alternative is the only alternative that offered a permanent solution for reduction of the toxicity, mobility, or volume of the contaminated material through treatment. This alternative is protective of human health and the environment, was ranked the best for three of the five modifying criteria including; long-term permanence, reduction of toxicity, mobility, or volume, and cost, and received generally favorable comments from the IDHW and public during the public involvement process. Monitoring of the soil, groundwater, and vegetation will continue for 20 years (2018) approximately 15 years after the RGs are met for each site in accordance with DOE Orders and the ANL-W Environmental Monitoring Plan, (ANL-W, 1998). The soil, groundwater, and vegetation monitoring results collected semi-annually will determine trends of low level radionulcide and inorganic contaminant levels around the ANL-W facility. After the RGs are met, CERCLA 5 year reviews would be required to ensure that the assumption of DOE control of the INEEL lands is still applicable. DOE anticipates that these five-year reviews will consist of a memorandum summarizing a checklist-driven inspection of the signs, fences, and other physical features that assure that DOE administrative controls are still in place. Phytoremediation would not be initiated on the Sanitary Sewage Lagoons because they will remain in service until approximately the year 2033 when the facility is scheduled for closure. Likewise, the Industrial Waste Pond phytoremediation will not be initiated until the cooling water discharges from the Sodium Processing Facility are completed. The final sodium cooling water discharges are currently planned for 2002. This delay in phytoremediation startup does not pose any unacceptable risks to human health and or the environment since these sites would be in a wetted condition. The major components of the selected remedy for ANL-W are:

- Completion of the phytoremediation workplan for the bench-scale testing
- Conducting a bench-scale phytoremediation test of selected plant species at the sites that pose unacceptable risks
- Determine effectiveness and implementability of phytoremediation based on results of bench-scale testing
- Collecting and analyzing of soil and plant samples from the two-year field season to determine the effectiveness of phytoremediation on the ANL-W soils insitu
- Harvesting, compacting, incinerating, and disposing of the above and below ground plant matter in a permitted landfill

- Continue planting/harvesting process until RAOs are attained if the two-year field-scale testing is successful

- Installing access restrictions consisting of fences, bird netting, and posting warning signs

- Review of the selected remedy no less than every five years until the RAOs have been met

- Implementation of DOE controls which limit residential land use for at least 100 years from now (2098).

Implementation of this alternative will increase the short-term human and ecological exposure to the contaminants. These short-term increases in exposure are estimated to last for five years and will ultimately reduce the long-term exposure of the contaminants to humans or the ecological receptors. Engineering controls will be used to reduce the short-term exposures to the human workers, while fencing, covering, and harvesting methods will be optimized to reduce the short-term exposure to the ecological receptors. These engineering controls will be further detailed and described in the RD Work Plan for WAG 9.

In summary, phytoremediation has been selected as the remedial alternative for cleanup of the eight areas at WAG 9 that pose unacceptable risks. Phytoremediation is an innovative treatment technology that appears to be the most appropriate remedy for WAG 9. However, bench-scale greenhouse testing and insitu field testing is needed to verify the technology's applicability for use on WAG 9 soils. The bench-scale greenhouse tests are currently being conducted and the results will indicate if the uptake rates are too low, or if it would take too long to meet the RGs. The results of the bench-scale greenhouse testing will determine if the selected remedial remedy will be replaced with the more conventional contingent alternative.

8.3 Selected Contingent Remedy

Alternative 4a, excavation and disposal at an on-INEEL facility has been selected as the contingent remedial remedy for the eight areas that pose unacceptable risks to human health and the environment. This contingent remedial alternative has been selected because it offers a proven technology to meet the RGs. This contingent remedy would be implemented if the selected remedial remedy (phytoremediation) does not prove adequate for use on the WAG 9 soils. Alternative 4a involves the physical removal of the contaminated soil at the eight areas at WAG 9. The soils will be transported to either the proposed INEEL Soils Repository or the RWMC facility. The final determination of which of these two facilities would be used will be determined during the remedial design phase after the ROD has been signed. The excavation with on-INEEL disposal alternative offers the highest degree of implementability and the second lowest costs of the retained alternatives. It is estimated that the excavation and disposal will take two years to complete after being initiated. DOE will continue soil, air, and groundwater monitoring for 20 years from now (to 2018) for the ANL-W site in accordance with DOE Orders and the ANL-W Environmental Monitoring Plan, (ANL-W, 1998). The soil, groundwater, and vegetation monitoring results collected semi-annually will determine trends of low level radionulcide and inorganic contaminant levels around the ANL-W facility. After the remediation goals are met, CERCLA 5 year reviews would be required to ensure that the assumption of DOE control of the INEEL lands is still applicable. DOE anticipates that these five-year reviews will consist of a memorandum summarizing a checklist-driven inspection of the signs, fences, and other physical features that assure that DOE administrative controls are still in place. The major components of the contingent remedy for ANL-W are:

- Contaminants in the waste areas will be excavated and transported to either the RWMC or the INEEL Soils Repository for on-INEEL disposal
- Verification sampling would be used to validate that the remaining soil concentrations are below the RAOs
- Review of the remedy no less than every five years until the RAOs have been met
- Implementation of DOE controls which limit residential land use for at least 100 years from now (2098).

The No action alternative is reaffirmed and selected as the appropriate alternative for the remaining 33 areas at the ANL-W facility. These 33 areas have risks that are at acceptable levels based on the information gathered during the remedial investigation.

The possibility exists that contaminated environmental media not identified by the INEEL FFA/CO or in this comprehensive investigation will be discovered in the future as a result of routine operations, maintenance activities, and decontamination and dismantlement activities at ANL-W. Upon discovery of a new contaminant source by DOE, IDHW, or EPA, that contaminant source will be evaluated and appropriate response action taken in accordance with the FFA/CO.

8.4 No Action Sites

The No Action alternative was reaffirmed as the appropriate alternative for 35 areas, 33 areas from WAG 9 and two sites from WAG 10. This alternative was chosen because there are no known or suspected contaminant releases, contaminants exceeding acceptable levels, or previous cleanups resulted in acceptable risks to human health and the environment. For this reason, long-term environmental monitoring is not warranted for these sites. It should be noted that these 36 No Action sites do not pose a cumulative risk. These 35 areas are listed below.

Operable Unit-None

- ANL-10 Dry Well between T-1 and ZPPR Mound
- ANL-11 Waste Retention Tank 783 (never used)
- ANL-12 Suspect Waste Retention Tank by 793 (removed 1979)
- ANL-14 Septic Tank and Drain Fields (2) by 753 (tank removed 1979)
- ANL-15 Dry Well by 768
- ANL-16 Dry Well by 759 (2)
- ANL-17 Dry Well by 720
- ANL-18 Septic Tank and Drain Field by 789 (removed 1979)
- ANL-20 Septic Tank and Leach Field by 793
- ANL-21 TREAT Suspect Waste tank and Leaching Field (non-radioactive)
- ANL-22 TREAT Septic Tank and Leaching Field
- ANL-23 TREAT Seepage Pit and Septic Tank W of 720 (filled 1980)
- ANL-24 Lab and office Acid Neutralization Tank

- ANL-25 Interior Building Coffin Neutralization Tank
- ANL-26 Critical Systems maintenance Degreasing Unit
- ANL-32 TREAT Control Building 721 Septic Tank and Leach Field (present)
- ANL-33 TREAT Control Building 721 Septic Tank and Seepage Pit (removed 1978)
- ANL-27 Plant Services Degreasing Unit

Operable Unit-9-01

- ANL-19 Sludge Pit W of T-7 (Imhoff Tank) (filled in 1979)
- ANL-28 EBR-II Sump (regeneration)
- ANL-29 Industrial Waste Lift Station
- ANL-30 Sanitary Waste Lift Station
- ANL-36 TREAT Photo Processing Discharge Ditch
- ANL-60 Knawa Butte Debris Pile
- ANL-61 EBR-II Transformer Yard
- ANL-62 Sodium Boiler Building (766) Hotwell
- ANL-63 Septic Tank 789-A

Operable Unit-9-02

- ANL-08 EBR-II Leach Pit (radioactive)

Operable Unit-9-03

- ANL-05 ANL Open Burn Pits #1 #2 and #3
- ANL-31 Industrial/Sanitary Waste Lift Station (industrial side not used)
- ANL-34 Fuel Oil Spill by building 755

Operable Unit-9-04

- ANL-01 Only the Ditch C portion of ANL-01
- ANL-53 Cooling Tower Riser Pits

Operable Unit-10-06

- ANL-W Stockpile site
- ANL-W Windblown Area

8.5 Remediation Goals

The purpose of selecting a remedial response action in this ROD is to formally document the remedial alternative and contingent alternative that will be implemented at WAG 9. The successful completion of the remediation technology will reduce the contaminant risks to acceptable levels for the human and environmental receptors. For the eight areas that require an action, phytoremediation is the selected treatment technology. Excavation and disposal has been selected as the contingent remedial alternative. The RGs are the same for either remedial alternative selected. These RGs are shown in Table 7-1 for each of the eight areas at ANL-W. Confirmation soil samples will be collected after the phytoremediation field seasons, or after excavation and disposal in order to ensure that the cleanup meets or exceeds the RGs.

8.6 Estimated Cost Details for the Selected Remedy

A summary of the costs for each of the alternatives retained for detailed analysis are shown in Tables 8-1 through 8-6. Table 9-3 shows the estimated costs for all the alternatives that met the threshold criteria for protection of human health and the environment.

Table 8-1. Detailed Cost Estiamte Summary Sheet for Alternative 3, Containment.

Cost Elements			Estimated Costs ($)
WAG 9 Management Costs			
CERCLA RD/RA Oversight	**Subtotal**		**$1,526,974**
Documentation Package			
Site surveying		$	47,250
Final Design Bid Package		$	7,000
Safety Analysis Report		$	8,750
Verification Sampling Plan		$	7,000
Verification Sampling Costs		$	10,500
Safe Work Permit		$	3,500
Radiation Work Permit		$	3,500
Excavation Permit		$	3,500
RCRA Subtitle D Landfill Application		$	35,000
	Subtotal		**$126,000**
Construction Costs			
Mobilization and Demobilization		$	70,000
Construction of Base		$	1,161,944
Density Testing of Base		$	7,000
Soil Removal		$	1,161,944
Backfill Site to Grade		$	1,619,444
Re-vegetation		$	192,350
Cap Construction		$	958,000
WAG 9 Construction Oversight		$	70,000
Fencing		$	150,600
Surface Water Diversion		$	30,120
	Subtotal		**$4,963,913**
Operations and Maintenance Costs			
Post-closure Management		$	812,500
Monitoring		$	1,196,000
WAG 9, Five-year Reviews		$	338,000
	Subtotal		**$2,346,500**
Total in 1998 dollars		**$**	**8,963,387**
Total in Net Present Value dollars*		**$**	**7,580,000**

* Net present value costs are determined by taking the cost estimates for performing the work in 1998 and assumes a constant 5% inflation rate to determine the projected future costs between 1999 and 2098. The total of these future costs are then totaled and a 5% discount rate is applied to determine the net present value.

Table 8-2. Detailed Cost Estimate Summary Sheet for Alternative 4a, Excavation and Disposal at the INEEL Soils Repository.

Cost Elements		Estimated Costs ($)	
WAG 9 Management Costs			
CERCLA RD/RA Oversight	**Subtotal**		**$1,232,496**
Documentation Package			
Site surveying		$	31,500
Final Design Bid Package		$	7,000
Safety Analysis Report		$	8,750
Verification Sampling Plan		$	7,000
Verification Sampling Costs		$	10,500
Safe Work Permit		$	3,500
Radiation Work Permit		$	3,500
Excavation Permit		$	3,500
Waste Acceptance Report to LMITCO		$	52,500
	Subtotal		**$127,750**
Construction Costs			
Mobilization and Demobilization		$	70,000
Soil Removal		$	1,161,944
Soil Transport to INEEL Repository		$	1,161,944
Tipping Fee/cy		$	232,388
Backfill Site to Grade		$	1,619,444
Re-vegetation		$	192,350
	Subtotal		**$4,438,070**
Operations and Maintenance Costs			
Post-closure Management		$	203,125
Monitoring		$	239,200
WAG 9, Five-year Reviews		$	338,000
	Subtotal		**$780,325**
Total in 1998 dollars		**$**	**6,578,641**
Total in Net Present Value dollars*		**$**	**5,876,000**

* Net present value costs are determined by taking the cost estimates for performing the work in 1998 and assumes a constant 5% inflation rate to determine the projected future costs between 1999 and 2098. The total of these future costs are then totaled and a 5% discount rate is applied to determine the net present value.

Table 8-3. Detailed Cost Estimate Summary Sheet for Alternative 4a, Excavation and Disposal at RWMC.

Cost Elements		Estimated Costs ($)	
WAG 9 Management Costs			
CERCLA RD/RA Oversight	**Subtotal**		**$1,232,496**
Documentation Package			
Site surveying		$	31,500
Final Design Bid Package		$	7,000
Safety Analysis Report		$	8,750
Verification Sampling Plan		$	7,000
Verification Sampling Costs		$	10,500
Safe Work Permit		$	3,500
Radiation Work Permit		$	3,500
Excavation Permit		$	3,500
Waste Acceptance Report to LMITCO		$	52,500
	Subtotal		**$127,750**
Construction Costs			
Mobilization and Demobilization		$	70,000
Soil Removal		$	1,161,944
Soil Transport to RWMC		$	1,549,259
Tipping Fee/cy		$	0
Backfill Site to Grade		$	1,619,444
Re-vegetation		$	192,350
	Subtotal		**$4,592,997**
Operations and Maintenance Costs			
Post-closure Management		$	203,125
Monitoring		$	239,200
WAG 9, Five-year Reviews		$	338,000
	Subtotal		**$780,325**
Total in 1998 dollars		**$**	**6,733,568**
Total in Net Present Value dollars*		**$**	**6,110,000**

* Net present value costs are determined by taking the cost estimates for performing the work in 1998 and assumes a constant 5% inflation rate to determine the projected future costs between 1999 and 2098. The total of these future costs are then totaled and a 5% discount rate is applied to determine the net present value.

Table 8-4. Detailed Cost Estimate Summary Sheet for Alternative 4b, Excavation with Disposal at Private Faciltiy.

Cost Elements		Estimated Costs ($)	
WAG 9 Management Costs			
CERCLA RD/RA Oversight	**Subtotal**		**$2,905,696**
Documentation Package			
Site surveying		$	31,500
Final Design Bid Package		$	7,000
Safety Analysis Report		$	8,750
Verification Sampling Plan		$	7,000
Verification Sampling Costs		$	10,500
Safe Work Permit		$	3,500
Radiation Work Permit		$	3,500
Excavation Permit		$	3,500
Waste Acceptance Report to LMITCO and Private Faciltiy		$	52,500
	Subtotal		**$127,750**
Construction Costs			
Mobilization and Demobilization		$	70,000
Soil Removal		$	1,161,944
Soil Transport to Railyard		$	1,161,944
Tipping Fee/cy		$	5,422,407
Backfill Site to Grade		$	1,619,444
Re-vegetation		$	192,350
	Subtotal		**$9,628,089**
Operations and Maintenance Costs			
Post-closure Management		$	203,125
Monitoring		$	239,200
WAG 9, Five-year Reviews		$	338,000
	Subtotal		**$780,325**
Total in 1998 dollars		**$**	**13,441,860**
Total in Net Present Value dollars*		**$**	**13,126,000**

* Net present value costs are determined by taking the cost estimates for performing the work in 1998 and assumes a constant 5% inflation rate to determine the projected future costs between 1999 and 2098. The total of these future costs are then totaled and a 5% discount rate is applied to determine the net present value.

Table 8-5. Detailed Cost Estimate Summary Sheet for Alternative 5, Phytoremediation.

Cost Elements		Estimated Costs ($)	
WAG 9 Management Costs			
CERCLA RD/RA Oversight	**Subtotal**		**$528,259**
Documentation Package			
Site surveying		$	8,400
Final Design Bid Package		$	7,000
Safety Analysis Report		$	8,750
Verification Sampling Plan		$	7,000
Verification Sampling Costs		$	21,000
Safe Work Permit		$	3,500
Radiation Work Permit		$	3,500
Excavation Permit		$	3,500
Waste Acceptance Report to LMITCO		$	35,000
	Subtotal		**$97,650**
Construction Costs			
Specialized Equipment Cost		$	300,000
Prepare Soil for Planting		$	28,852
Planting/growing season		$	28,852
Irrigating/growing season		$	57,705
Fertilizing/growing season		$	14,426
Harvesting/growing season		$	28,852
Bailing/growing season		$	28,852
Rad Surveys/growing season		$	12,022
Transport to INEEL WERF Incinerator/season		$	28,852
Additional Four Year Phyto Costs		$	913,662
Fencing		$	150,600
Surface Water Diversion		$	30,120
	Subtotal		**$1,622,795**
Operations and Maintenance Costs			
Post-closure Management		$	203,125
Monitoring		$	239,200
WAG 9, Five-year Reviews		$	338,000
	Subtotal		**$780,325**
Total in 1998 dollars		**$**	**3,029,029**
Total in Net Present Value dollars*		**$**	**2,824,000**

* Net present value costs are determined by taking the cost estimates for performing the work in 1998 and assumes a constant 5% inflation rate to determine the projected future costs between 1999 and 2098. The total of these future costs are then totaled and a 5% discount rate is applied to determine the net present value.

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9 STATUTORY DETERMINATIONS

The selected and contingent remedy for remediation of the eight WAG 9 areas meets the statutory requirements for CERCLA § 121, the regulations contained in the NCP, and the requirements of the FFA/CO for the INEEL. Both remedies meet the threshold criteria established in the NCP (i.e., protection of human health and the environment and compliance with ARARs). CERCLA also requires that the remedy use permanent solutions and alternative treatment technologies, to the maximum extent practical, and that the implemented action be cost effective. Finally, the statute includes a preference for remedies that employ treatment to permanently and significantly reduce the toxicity, mobility, or volume through treatment.

Phytoremediation works well for sites that have relatively shallow contamination over a large area at concentrations slightly above the cleanup levels. This is the case for the eight areas at WAG 9. Two of these areas that have low levels of radionuclide contamination, five areas have slightly elevated levels of inorganics, and one area has both low levels of radionuclides and inorganics. It is anticipated after the remedial action, none of the 39 total sites at WAG 9 will have contaminated soils and sediments left in place at levels associated with a risk greater than 1E-04 or a hazard quotient greater that 10 times the background hazard quotient. However, after the remediation goals are met, CERCLA 5 year reviews would be required to ensure that the assumption of DOE control of the INEEL lands is still applicable.

9.1 Protection of Human Health and the Environment

As previously described in Section 8, both the selected phytoremediation and the contingent excavation and disposal remedies can meet the RGs described in Table 7-1 that ensure protection of human health and the environment. The phytoremediation alternative will utilize treatment to remove contaminants from soils to levels at or below the RGs. While the contingent alternative excavation with on-INEEL disposal, will ensure protection of human health and the environment by physically removing the contaminated soil to levels below the RGs.

9.2 Compliance with ARARs and To Be Considered

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law which specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Relevant and appropriate requirements are those same standards mentioned for applicable requirements, except while not applicable at the CERCLA site, address problems or situations sufficiently similar to those encountered at the site such that their use is well suited to the particular site.

Three types of ARARs exist: location-specific, action-specific, and chemical-specific. In general, location-specific ARARs place restrictions on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations. Action-specific ARARs are usually technology or activity based requirements or limitations on actions or conditions involving specific substances. Chemical-specific ARARs are health or risk-based numerical values or methodologies that result in the establishment of numerical values. The values establish the acceptable concentrations of chemicals or substances that may be found in or discharged to the environment.

Documents that are not legally binding are identified as To-Be-Considered (TBC) guidance or procedures documents. Both the selected phytoremediation and the contingent excavation and on-INEEL disposal facility meet the TBC procedures or guidance documents that were identified by the agencies. The following two sections identify the specific ARARs and TBCs that were considered for the selected and contingent alternatives to be remediated at WAG 9.

9.2.1 Selected Remedy Compliance with ARARs

Implementation of phytoremediation remedy will be designed to comply with all chemical-, action-, and location-specific Federal and State ARARs, and TBCs as shown in Table 9-1. Table 9-1 lists each the ARAR statutes, specific citation reference, reason why the ARAR is retained, relevancy, and how DOE will attain compliance with the ARAR. In addition to including the ARARs in Table 9-1, the TBCs are also included. For the ANL-W facility, the TBCs consist of DOE Orders which act as guidance documents for work practices at DOE facilities. These DOE Orders are TBCs and are used in the absence of applicable state or federal regulations. As shown in Table 9-1, all of the ARARs and TBCs for the selected phytoremediation remedy can be met.

Other Federal and State laws are not included as ARARs for WAG 9 but may be invoked during future phases of the phytoremediation remedy. The future phases involve the disposal of ash at the Waste Experimental Reduction Facility (WERF) from the incineration of the contaminanted plant matter generated during phytoremediation. The resultant ash will be tested and depending on the results, either be disposed of at an approved Hazardous waste Treatment, Storage, and Disposal facility or a subtitle D landfill. The sampling and disposal of the incinerated ash will be conducted under the standard operating procedures outlined in the latest revision of the Reusable Property, Recyclable Materials, and Waste Acceptance Criteria (RRWAC) document. The two action-specific laws, IDAPA 16.01.05.008 (40 CFR 264) -"Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal facilities" and IDAPA 16.01.05.011 (40 CFR 268)-"Land Disposal Restrictions" have not been included as ARARs but may become applicable to the disposal facility if the incinerated ash is found to be a land disposal restricted hazardous waste. Another action specific law, IDAPA 16.01.05.006 (40 CFR 262.34) "Accumulation of Waste" may become applicable if plant matter is determined to be a hazardous waste, and if a large quantity of plant matter must be accumulated at ANL-W prior to shipping. One chemical-specific law, IDAPA 16.01.11.200-Idaho Groundwater Quality Rule" has not been included as an ARAR but may become applicable if future groundwater concentrations exceed those levels that were predicted in the OU 9-04 Comprehensive RI/FS. Currently DOE does not exceed any of these regulated groundwater concentrations at WAG 9 and does not expect to exceed them in the future. However, DOE will continue with groundwater monitoring in accordance with the ANL-W Environmental Monitoring Program.

9.2.2 Contingent Remedy Compliance with ARARs

Implementation of the contingent remedy of excavation with on-INEEL disposal will comply with all chemical-, action-, and location-specific Federal and State ARARs, and TBCs as shown in Table

Table 9-1. Evaluation of ARARs and TBC compliance for the selected remedy- Alternative 5: phytoremediation.

ARAR Statute	Citation	Reason	Relevancy	Attained by
Action				
Idaho Fugitive Dust Emissions	IDAPA 16.01.01.650	To control dust during excavation/farming operations.	Applicable	Application of water and/or chemical dust suppressants to land disturbed by excavation and/or farming operations.
Idaho Hazardous Waste Management Act	IDAPA 16.01.05.005 (40 CFR 261)—"Identification and Listing of Hazardous Waste"	All plant materials will need to be sampled for hazardous materials prior to shipment to an incinerator.	Applicable	Plant material samples will be collected and analyzed to determine if the plant matter is regulated hazardous waste.
Idaho Hazardous Waste Management Act	IDAPA 16.01.05.006 (40 CFR 262.11)—"Hazardous Waste Determination"	All waste that could potentially contain hazardous constituents must be sampled using approved methods.	Applicable	Plant material samples will be tested using approved EPA methods to determine if the plant matter is regulated as a hazardous waste.
General Requirements for Shippers	49 CFR 173	DOE will have to comply with the requirements for packaging and transporting of radioactive and hazardous material to an incinerator.	Applicable	These packaging and transportation regulations will be met by placing the waste in appropriate shipping container and applying the appropriate placards.
National Contingency Plan - Procedures for planning and implementing off-site response actions	40 CFR 300.440	The statute will apply if incinerated ash is a RCRA regulated hazardous waste and is shipped off-site for disposal.	Applicable	If determined to be a hazardous waste, the ash will be shipped off-site to a RCRA Subtitle C landfill which is operated in compliance with RCRA.
Chemical				
NESHAPS-Radionuclides other than Radon-222 and Radon-220 at DOE facilities-Emission Standard	40 CFR 61.92	Limits the exposure of radioactive contaminant release to 10 mrem/year for the off-site receptors.	Applicable	Monitors for airborne radionuclides are currently installed around the ANL-W facility and can be supplemented with additional portable monitors if necessary. Dust control measures will also help limit the release of radioactive contaminants.

Table 9-1. (Continued).

ARAR Statute	Citation	Reason	Relevancy	Attained by
Rules for the Control of Air Pollution in Idaho	IDAPA 16.01.01.585 and 586	Idaho rules governing the release and verification of carcinogenic and noncarcinogenic contaminants into the air.	Applicable	The phytoremediaiton will add live vegetation as a soil cover material that will prevent the release of dust/air pollution due to wind erosion. Air monitoring will be used to verify that the limits specified in 585 and 586 are not exceeded.
Location				
Archeological and Historic Preservation Act	16 USC 470	This will be applicable if unexpected cultural artifacts are uncovered during excavation/farming operations.	Relevant and Appropriate	The areas at WAG 9 that will be remediated are less than 50 year old man made ditches and ponds and have not been identified as having cultural significance. If cultural artifacts are encountered, DOE will stop work and conduct a detailed survey of the area.
To Be Considered				
Environmental Protection, Safety, and Health Protection Standards	DOE Order 440.1	DOE Orders for protecting workers.	To Be Considered	Worker compliance with Standard Operating Procedures specified in the DOE Order-based Environmental Safety and Health manual ensures safe remediation activities.
Radioactive Waste Management	DOE Order 5820.2A and 435.1 in FY 2000	DOE Orders provide guidance on disposal of low-level radioactive waste.	To Be Considered	Worker compliance with Standard Operating Procedures specified in the DOE Order-based Environmental Safety and Health manual and the Waste Handling manual ensures safe packaging and disposal of low-level radioactive waste.
Radiation Protection of the Public and Environment	DOE Order 231.1	DOE Orders that provide guidance on radiological environmental protection and guidelines on cleanup of residual radioactive material prior to release of the property.	To Be Considered	Worker compliance with Standard Operating Procedures specified in the DOE Order-based Environmental Safety and Health manual ensures protection of the public and enviornment from radiological hazards.

Table 9-2. Evaluation of ARARs and TBC compliance for the contingent remedy - excavation and On-INEEL disposal of contaminated soils.

ARAR Statute	Citation	Reason	Relevancy	Attained by
Action				
Idaho Fugitive Dust Emissions	IDAPA 16.01.01.650	To control dust during excavation operations.	Applicable	Application of water and/or chemical dust suppressants to land disturbed by excavation/trucking operations.
General Requirements for Shippers	49 CFR 173	DOE will have to comply with the requirements for packaging and transporting of radioactive and hazardous material to on-INEEL disposal site.	Applicable	These packaging and transportation regulations will be met by placing the waste in appropriate shipping containers and applying the appropriate placards.
Chemical				
NESHAPS-Radionuclides other than Radon-222 and Radon-220 at DOE facilities-Emission Standard	40 CFR 61.92	Limits the exposure of radioactive contaminant release to 10 mrem/year for the off-site receptors.	Applicable	Monitors for airborne radionuclides are currently installed around the ANL-W facility and can be supplemented with additional monitors if necessary. Dust control measures will limit the release of radioactive contaminants.
Rules for the Control of Air Pollution in Idaho	IDAPA 16.01.01.585 and 586	Idaho rules governing the release and verification of carcinogenic and noncarcinogenic contaminants into the air.	Applicable	The excavation and truction operations will use water and chemical suppressants to limit the release of dust. Revegetation of the disturbed areas will be completed after the excavations. Air monitoring will be used to verify that the limits specified in sections 585 and 586 are not exceeded.

Table 9-2 (Continued).

ARAR Statute	Citation	Reason	Relevancy	Attained by
Location				
Archeological and Historic Preservation Act	16 USC 470	This will be applicable if unexpected cultural artifacts are uncovered during excavation operations.	Relevant and Appropriate	The areas at WAG 9 that will be remediated are less than 50 years old man made ditches and ponds and have not been identified as having cultural significance. If cultural artifacts are encountered, DOE will stop work and conduct a detailed survey of the area.
To Be Considered				
Environmental Protection, Safety, and Health Protection Standards	DOE Order 440.1	DOE Orders for protecting workers.	To Be Considered	Worker compliance with Standard Operating Procedures specified in the DOE Order-based Environmental Safety and Health manual ensures safe remediation activities.
Radioactive Waste Management	DOE Order 5820.2A and 435.1 in FY 2000	DOE Orders provide guidance on disposal of low-level radioactive waste.	To Be Considered	Worker compliance with Standard Operating Procedures specified in the DOE Order-based Environmental Safety and Health manual and the Waste Handling manual ensures safe packaging and disposal of low-level radioactive waste.
Radiation Protection of the Public and Environment	DOE Order 231.1	DOE Orders that provide guidance on radiological environmental protection and guidelines on cleanup of residual radioactive material prior to release of the property.	To Be Considered	Worker compliance with Standard Operating Procedures specified in the DOE Order-based Environmental Safety and Health manual ensures protection of the public and enviornment from radiological hazards.

9-2. Table 9-2 lists each the ARAR statutes, specific citation reference, reason why the ARAR is retained, relevancy, and how DOE will attain compliance with the ARAR. In addition to including the ARARs in Table 9-2, the TBCs are also included. For the ANL-W facility, the TBCs consist of DOE Orders which prescribe minimum standards for work practices at DOE facilities. These DOE Orders are TBCs and are used in the absence of applicable state or federal regulations. As shown in Table 9-2, all of the ARARs and TBCs for the contingent remedy of excavation and On-INEEL disposal can be met.

Other Federal and State laws are not included as ARARs for WAG 9 but may be invoked for the on-INEEL disposal site operator. The operator of the disposal site will have to comply with these action-specific laws: IDAPA 16.01.05.008 (40 CFR 264) -"Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal facilities" and IDAPA 16.01.05.011 (40 CFR 268)-"Land Disposal Restrictions". One chemical-specific law, IDAPA 16.01.11.200-Idaho Groundwater Quality Rule" has not been included as an ARAR but may become applicable to the contingent remedy if future groundwater concentrations exceed those levels that were predicted by the OU 9-04 Comprehensive RI/FS. Currently ANL-W does not exceed any of these regulated groundwater concentrations and does not expect to exceed them based on modeling results. However, DOE will continue with groundwater monitoring in accordance with the ANL-W Environmental Monitoring Program.

9.3 Cost Effectiveness

The selected remedial action of phytoremediation for the ANL-W sites of concern is cost effective because it is anticipated that its costs will be the lowest of those alternatives that met the RAOs. The costs for phytoremediation will depend on the actual uptake percentages for the radionuclide and inorganic contaminants that are being determined during the bench-scale testing. The contingent remedy of excavation with on-INEEL disposal offers the second lowest costs for meeting the RAOs. The costs for the excavation with on-INEEL disposal costs are well defined since the packaging and transportation of hazardous and low level radioactive wastes are routine operations.

Table 9-3 summarizes the estimated costs in net present value for all of the alternatives that were retained for detailed analysis. These costs were estimated assuming an annual inflation rate of 5%. The selected remedy of phytoremediation is the most cost effective remedial alternative for all eight areas with the exception of the Industrial Waste Pond. The contingent remedy of excavation and on-INEEL disposal is the next lowest cost alternative. The variations in costs between the phytoremediation and the excavation and on-INEEL disposal depended on the depth of contamination and surface area of the remedial sites. Compared to excavation and disposal, the costs of phytoremediation are lower for sites that have relatively large surface areas and which have contamination at relatively shallow depths (i.e., 0.5 to 4 feet). Due to cost savings which can be realized on overhead and equipment costs when one cleanup technique is applied to all WAG 9 sites, phytoremediation was selected for all WAG 9 sites. Costs for the bench-scale greenhouse testing have not been included into the phytoremediation alternatives for each site. These bench-scale greenhouse costs are relatively small (less than $200,000) and are being incurred prior to the signing of the ROD and as such are considered pre-ROD costs.

9.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Possible

The selected remedy will result in the permanent removal of contaminants from the soil and will concentrate the wastes, minimizing the volume of waste to be disposed. The phytoremediation is designed to work on sites that contain radionuclide and/or inorganically contaminated wastes. Tests on the effectiveness of phytoremediation to extract the radionuclides and/or inorganics from the ANL-W soils are currently being performed. The outcome of these tests will determine the implementability of phytoremediation prior to the start of the 1999 growing season. The contingent remedy of excavation and on-INEEL disposal offers a permanent solution to the removal of the radionuclide and/or inorganic wastes from ANL-W in a non-concentrated form. Both the selected and the contingent remedies offer permanent solutions since both alternatives will remove the contaminants from the ANL-W site.

Table 9-3. Net present value of capital, operating and maintenance (O&M) and total cost for remedial alternatives at OU 9-04 sites.

Alternative	Technology	Capital Costs	Operations and Maintenance Costs	Total Cost
Alternative 3a	Engineered Cover with Institutional Controls	$6,625,000.00	$954,000.00	$7,580,000.00
Alternative 4a	Excavation and Disposal at the On-INEEL Proposed INEEL Soils Repository	$5,340,000.00	$535,000.00	$5,876,000.00
Alternative 4a	Excavation and Disposal at the On-INEEL RWMC Facility	$5,575,000.00	$535,000.00	$6,110,000.00
Alternative 4b	Excavation and Disposal at a Private Off-INEEL Facility	$12,591,000.00	$535,000.00	$13,126,000.00
Alternative 5	Phytoremediation with Off-INEEL Disposal of Plant Matter/Ash	$2,289,000.00	$535,000.00	$2,824,000.00

9.5 Preference for Treatment as a Principal Element

The selected remedial remedy of phytoremediation, satisfies the criterion for treatment of the contaminated media. The phytoremediation is an innovative treatment technology that appears to be the most appropriate remedy for cleanup of both radionuclide- and inorganically-contaminated soils at WAG 9. CERCLA grants preferential treatment to technologies that treat soils to reduce principal wastes. Field tests will be conducted to verify the perfomance of phytoremediation on the ANL-W soils. The contingent remedy, excavation with on-INEEL disposal, does not include treatment, but does provide a proven conventional technology to meet the established RGs for each of the eight areas at WAG 9.

10 DOCUMENTATION OF SIGNIFICANT CHANGES

CERCLA Section 117(b) requires that an explanation of any significant changes from the preferred alternative originally presented in the Proposed Plan be provided in the ROD.

Cost estimates for Alternatives 4a excavation and disposal at the RWMC have since been prepared. These costs are similar in magnitude to those of the Alternative 4a for the proposed INEEL Soils Repository. Costs are slightly higher because of the increase in travel costs associated with the longer transportation distance. The overall project costs for Alternative 4a using the proposed INEEL Soils Repository or the RWMC facility are considered to be essentially the same. Thus, if the selected alternative does not work, and the contingent alternative is implemented, the final selection of which disposal option in Alternative 4a will be made during the remedial design phase.

One area, the Ditch C portion of ANL-01 was identified as having inorganic contaminants that posed unacceptable risks to the ecological receptors in the Proposed Plan. This area has now been eliminated as an area requiring remediation. In preparation of the Screening Level Ecological Risk Assessment (SLERA) the maximum contaminant concentrations were used to calculate the HQ for the ecological receptors. These HQs were determined by using the maximum contaminant concentration at these two sites. New HQs have been calculated for all WAG 9 sites using the 95% UCL concentrations reported in Appendix A of the OU 9-04 Comprehensive RI/FS. Under CERCLA the calculation of the contaminant concentration is based on a reasonable maximum exposure (RME). The 95% UCL concentration is more reasonable than using the maximum concentration when the number of samples in the data set is greater than 10. The result of using the 95% UCL concentration verses the maximum concentration reduced the ecological receptors HQs at these two sites to acceptable levels. Thus, the Ditch C portion of ANL-01 will no longer require remedial action because the 95% UCL inorganic concentrations are below the remediation goal concentrations. The remaining six areas identified in the Proposed Plan as having inorganics that posed unacceptable risks to the ecological receptors, have had similar refinements in the calculation of the HQs using 95% UCL values verses the maximum concentrations. These remaining six areas are; Industrial Waste Pond (ANL-01), Ditch A (ANL-01), Ditch B (ANL-01), Main Cooling Tower Blowdown Ditch (ANL-01A), Sewage Lagoons (ANL-04), and the Industrial Waste Liftstation Discharge Ditch (ANL-35). All of these six areas still have at least one inorganic contaminant at concentrations above the RGs and are still retained for remedial action.

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11 RESPONSIVENESS SUMMARY

The Responsiveness Summary is designed to provide the agencies with information about community preferences regarding the selected remedial alternatives and general concerns about the site. Secondly, it summarizes how public comments were evaluated and integrated into the decision-making process and records how the agencies responded to each of the comments. Appendix A provides a summary of community involvement in the CERCLA process for OU 9-04 and a summary of comments received and corresponding agency responses.

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